

Twist, Throw and Recover: Physiotherapy Management of Injuries in Shot Put Players

A Narrative Review

Kanak Gyan Gupta¹, Abhilasha Rakesh Vishwakarma², Rutuja Ravindra Gurav³, Dr Shashwat Joshi (Pt)⁴, Dr Priyaranjan Chaudhary (Pt)⁵

^{1,2,3}rd Year Bpt Student Ideal Institute of Physiotherapy, Ideal Institute of Physiotherapy, Palghar, 421303

⁴Assistant Professor Ideal Institute of Physiotherapy, Ideal Institute of Physiotherapy, Palghar, 421303

⁵Professor Ideal Institute of Physiotherapy, Ideal Institute of Physiotherapy, Palghar, 421303

Abstract:

Background:

Shot put is a throwing event that requires rapid and coordinated movement of the lower limbs, pelvis, trunk, and upper limb. The rotational and twisting components of the throwing action can place considerable mechanical demands on the musculoskeletal system. Appropriate physiotherapy assessment and rehabilitation may help address mobility restrictions, muscle weakness, strength asymmetry, and impaired kinetic-chain coordination associated with athletic performance and injury risk. However, evidence specifically addressing twisting injuries and physiotherapy management in shot put athletes remains limited.

Objective:

The objective of this narrative review was to examine the available evidence regarding injuries in shot put players and to identify relevant physiotherapy approaches for assessment, rehabilitation, and injury prevention.

Methodology:

A narrative literature review was conducted using **PubMed and Google Scholar**. Searches were performed using combinations of keywords related to *shot put*, *shot put athletes*, *twisting injury*, *rotational injury*, *throwing athletes*, *overhead athletes*, *sports injury*, *physiotherapy*, *rehabilitation*, and *injury prevention*. The Boolean operators **AND** and **OR** were used to combine search terms. Articles published from **2020 onwards** were considered. Studies involving male and female athletes were eligible, including randomized controlled trials, observational studies, cross-sectional studies, cohort studies, case reports, case series, and relevant review articles. Studies involving shot-put athletes were prioritized, while research involving related throwing and overhead athletes was included as supporting evidence when direct shot-put literature was limited. Studies unrelated to athletic populations, rotational or throwing

activities, physiotherapy, injury mechanisms, rehabilitation, or prevention were excluded. A total of **8 relevant articles** were included in the narrative review.

Results:

The reviewed literature indicated that rotational athletic performance is influenced by the interaction of strength, mobility, neuromuscular control, and coordination. Kinematic-chain training in university shot-put athletes was associated with improvements in throwing distance and shoulder muscle strength. Video analysis also demonstrated differences between glide and rotational shot-put techniques, indicating that throwing technique may influence performance characteristics. Evidence from related throwing populations suggested associations between restricted cervical mobility and throwing-related shoulder or elbow problems. Studies of athletic populations additionally identified differences in muscle activation and limb strength, highlighting the importance of assessing asymmetry and movement control. Collectively, the findings support a comprehensive physiotherapy approach incorporating kinetic-chain strengthening, mobility training, neuromuscular control, rotational stability, sport-specific training, and progressive return to throwing.

Conclusion:

The available evidence suggests that physiotherapy management of twisting and rotational problems in shot put should address the athlete as a whole kinetic chain rather than focusing only on the symptomatic region. Assessment of strength, mobility, muscle balance, trunk control, movement coordination, and throwing technique may assist in developing an individualized rehabilitation programme. Nevertheless, direct research on twisting injuries specifically in shot-put athletes is limited, and evidence from other throwing populations should therefore be interpreted cautiously. Further shot-put-specific research is required to establish evidence-based rehabilitation and injury-prevention strategies.

Keywords: Shot put; twisting injury; rotational injury; physiotherapy; rehabilitation; throwing athletes; kinetic chain; injury prevention.

INTRODUCTION

Shot put is a complex throwing activity that relies on the coordinated transfer of force through the kinetic chain, beginning with the lower limbs and progressing through the pelvis, trunk, shoulder, arm, wrist, and hand. Any disruption in this sequence may increase the risk of injury.¹

An epidemiological study of U.S. high school track and field throwing events identified 267 throwing-related injuries among more than 5.4 million athlete exposures. The shoulder accounted for the largest proportion of injuries (21.7%), followed by the ankle and knee, while muscle strains and ligament sprains were frequently reported.²

The rotational shot put technique is performed through a sequence of distinct phases. Successful performance is influenced by angular momentum, movement of the thrower-shot system, appropriate timing of the lower and upper limbs, and effective separation between the hips and shoulders.³ Three-dimensional biomechanical research on rotational shot putting has highlighted several factors associated

with performance, including elbow angular velocity, rotation of the shoulder axis, hip–shoulder coordination, force exerted on the shot, kinetic energy, and velocity at release.⁴ The shoulder experiences substantial compressive loading and horizontal-adduction torque during rotational shot putting, while the elbow is exposed to its own combination of forces and torques. These mechanical stresses can place considerable demands on the throwing upper limb.⁵

Rotational shot putting involves multiple biomechanical factors that influence the velocity of the shot at release. The impulse applied to the shot and the development of linear and angular momentum before the delivery phase are particularly important for effective performance.⁶

Shot put is a coordinated pushing action involving several joints of the upper limb. Proper synchronization of these joints during the release phase is essential for generating an effective throwing motion and maximizing performance.⁷ Studies of shot put athletes have examined the physical characteristics of the upper-limb and trunk musculature. In particular, the cross-sectional area of muscles has been investigated in relation to throwing performance.⁸

An eight-week exercise programme based on the kinetic chain incorporated exercises for the lower limbs, core, and upper body in university shot put athletes. The programme examined changes in shoulder muscle strength and throwing performance, emphasizing the contribution of the entire kinetic chain to shot put performance.⁹ Analysis of NCAA injury data indicated that athletes participating in throwing events experienced a relatively high proportion of injuries involving the spine and upper extremities when compared with several other track and field event categories.¹⁰

Investigations of injuries occurring during international athletics championships demonstrated that injury patterns varied between different athletic disciplines. Among throwing-event athletes, injuries involving the trunk and muscles of the lower leg were among the patterns documented¹¹.

Studies investigating injuries associated with track and field throwing activities have reported a notable occurrence of strains, sprains, and upper-extremity injuries among shot put participants. Injuries involving the wrist, hand, and fingers have also been documented.¹² Throwing is a whole-body activity that depends on the coordinated generation and transfer of force. Within this kinetic chain, the shoulder plays an important role in transferring force produced by the lower extremities toward the arm and hand.¹³

Shoulder injuries in throwing athletes may develop due to several contributing factors, such as repetitive or excessive throwing, high mechanical loading, inefficient movement mechanics, weakness within the kinetic chain, inappropriate muscle activation patterns, and inadequate coordination.¹⁴ Repeated exposure to high forces and extensive shoulder rotation during throwing can lead to both adaptive and potentially harmful changes in the shoulder. Throwing athletes may also experience limitations in internal rotation and conditions associated with internal impingement.¹⁵

Repetitive mechanical stress associated with throwing may contribute to various shoulder conditions, including rotator-cuff tendinopathy, instability, changes involving the labrum, rotator-cuff fibre damage, and secondary impingement.¹⁶

Shoulder pain among throwing athletes may arise from different structures and mechanisms, including altered scapular function, glenohumeral or capsulolabral abnormalities, rotator-cuff disorders, and

neurovascular involvement.¹⁷ Appropriate flexibility, strengthening, and conditioning programmes are therefore important components of athlete preparation. A systematic review has emphasized the importance of the kinetic chain in preventing shoulder injuries among throwing athletes. Preventive programmes incorporating core stability, lower-limb strengthening, muscular conditioning, balance, and efficient transfer of energy may help decrease excessive mechanical stress on the shoulder.¹⁸

Studies involving overhead athletes have reported improvements with physiotherapy-based interventions targeting strength, mobility, neuromuscular control, and movement mechanics. These findings may provide supporting evidence for rehabilitation approaches in shot-put athletes, although direct transferability remains uncertain

Direct research investigating twisting injuries and physiotherapy management specifically in shot-put athletes is limited. Therefore, evidence from studies involving overhead and throwing athletes was also considered to provide relevant information regarding rotational demands, injury mechanisms, rehabilitation strategies, and injury prevention. Although these athletes participate in different sports, the repetitive throwing and rotational movements involved may provide useful supporting evidence for physiotherapy management in shot-put athletes.

Methodology

A **narrative literature review** was conducted to examine the role of physiotherapy in the management and prevention of twisting and rotational injuries among shot put athletes. A literature search was performed using the electronic databases **PubMed and Google Scholar**.

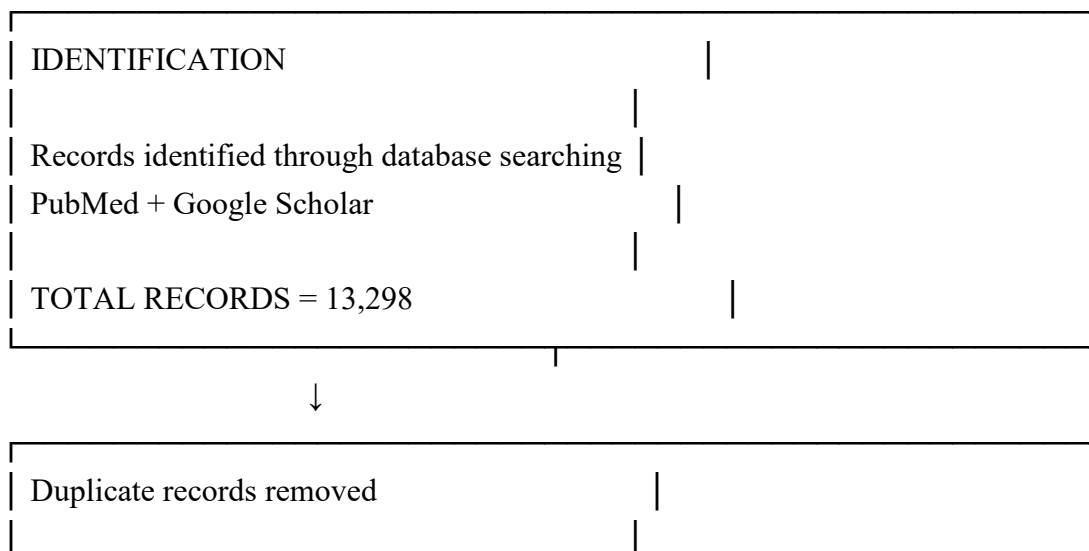
A combination of keywords and Boolean operators **AND** and **OR** was used to identify relevant literature. The search terms included “**shot put,**” “**shot put athletes,**” “**twisting injury,**” “**rotational injury,**” “**throwing athletes,**” “**overhead athletes,**” “**sports injury,**” “**physiotherapy,**” “**rehabilitation,**” and “**injury prevention.**”

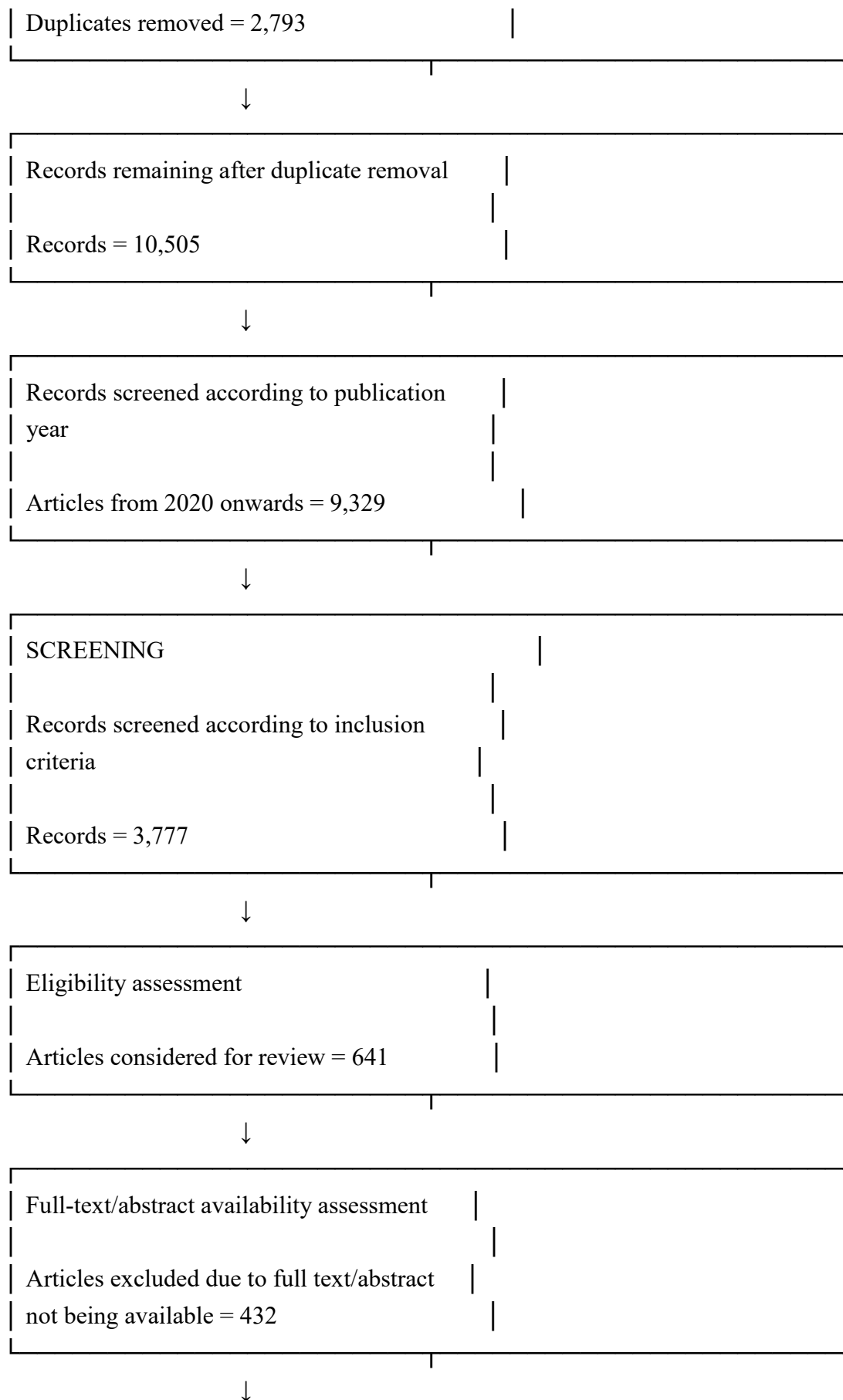
As this was a **narrative review**, studies were not restricted according to a particular research design. Relevant **randomized controlled trials, observational studies, cohort studies, case reports, biomechanical studies, systematic reviews, and narrative reviews** were considered. Studies specifically involving shot put athletes were given priority. However, because direct evidence concerning twisting injuries in shot put athletes was limited, relevant literature involving **throwing and overhead athletes** was also considered as supporting evidence.

Inclusion Criteria	Exclusion Criteria
Articles published from 2020 onwards	Articles published before 2020
Studies involving male and/or female athletes	Studies involving non-athletic populations
Studies involving shot put athletes	Studies unrelated to shot put or throwing/overhead athletes

Inclusion Criteria	Exclusion Criteria
Relevant studies involving throwing or overhead athletes where direct shot-put evidence was limited	Studies with no relevance to throwing, rotational movement, or related sports injuries
RCTs	Studies not meeting the stated eligibility criteria
Observational studies	Articles with insufficient information regarding the study population or outcomes
Cross-sectional studies	Duplicate articles
Cohort studies	Articles unavailable in full text
Case-control studies	Articles unrelated to physiotherapy, rehabilitation, injury mechanisms, or injury prevention
Case reports/series , when clinically relevant	Studies focusing exclusively on unrelated medical conditions
Systematic reviews and narrative reviews relevant to the topic	Non-relevant reviews
Studies reporting injury mechanisms, risk factors, physiotherapy, rehabilitation, or injury prevention	Studies without relevant information on injury, rehabilitation, or prevention
Articles available in English	Articles published in languages other than English

PRISMA-STYLE FLOW DIAGRAM





INCLUDED	
Articles meeting the eligibility criteria and included in the narrative review	
FINAL ARTICLES INCLUDED = 8	

Topic / Article Name	Methodology	Outcome Measures	Results
1. Effect of Kinematic Chain Exercise Protocol on Throwing Performance and Shoulder Muscle Strength among University Shot Put Athletes – A Randomized Controlled Trial	Randomized controlled trial involving 80 university shot-put athletes (19.87 ± 1.31 years). Participants were randomly allocated to an experimental group (n=40) and control group (n=40). The experimental group performed an 8-week kinematic-chain exercise program , while the control group continued usual training. Pre- and post-training assessments were performed. Two-way ANOVA was used for analysis.	Throwing distance; shoulder muscle strength; athlete satisfaction with the exercise program.	The kinematic-chain group demonstrated significantly greater improvement in throwing distance (p=0.01) and shoulder muscle strength (p=0.01) compared with the control group. Athlete satisfaction also significantly improved (p=0.005).
2. Video Analysis of Throwing Techniques in Collegiate Shot-Put Athletes: A Visual Exploration of Throwing Styles and Performance Factors	Observational/video-analysis study involving 220 collegiate shot-put athletes aged 18–25 years from universities around Bangalore. Throwing techniques were recorded using two high-definition cameras and analyzed	Throwing velocity; throwing distance; throwing technique; BMI; technique differences between male and female athletes.	The glide technique had a higher mean velocity rank in both males and females compared with the rotational technique. The glide technique was the most prevalent and demonstrated better throwing distance than the

Topic / Article Name	Methodology	Outcome Measures	Results
	using Kinovea software . Glide and rotational techniques were compared according to throwing performance and athlete characteristics.		rotational technique. BMI was significantly associated with technique selection (p=0.0001).
3. Effect of Kinematic Chain Exercise Protocol on Throwing Performance and Shoulder Muscle Strength among University Shot Put Athletes – A Randomized Controlled Trial	Randomized controlled trial of 80 university shot-put athletes , randomly assigned to experimental (n=40) and control (n=40) groups. The experimental group completed an 8-week kinematic-chain exercise program , while the control group continued usual training. Pre- and post-training assessments were performed and analyzed using two-way ANOVA.	Throwing distance; shoulder muscle strength; participant satisfaction.	The experimental group showed significantly greater improvement in throwing distance (p=0.01) and shoulder muscle strength (p=0.01) compared with the control group. Satisfaction with the training program also increased significantly (p=0.005).
4. Performance, Test-Retest Reliability, and Measurement Error of the Upper Limb Seated Shot Put Test According to Different Positions of Execution	Test-retest reliability study involving 44 overhead athletes . Participants performed the unilateral seated shot-put test from two positions: floor (USSPT-F) and chair (USSPT-C). Reliability was assessed using the Intraclass Correlation Coefficient (ICC) , while measurement error was assessed using SEM, SDC, and Bland–Altman analysis.	Upper-limb shot-put performance; test-retest reliability; measurement error; dominant and non-dominant limb performance.	Women performed better on the chair position than the floor position. The floor test showed excellent reliability for the dominant (ICC=0.97) and non-dominant (ICC=0.95) sides. The chair test showed moderate-to-excellent reliability (ICC=0.91 dominant; ICC=0.74 non-dominant). Systematic error was identified only for the

Topic / Article Name	Methodology	Outcome Measures	Results
			dominant side of the chair test (14.76 cm; p=0.011).
5. Association of Head-Neck Rotation With History of Pitching-Related Elbow Pain in Youth Baseball Players	Cross-sectional study involving 311 youth baseball players . Participants completed questionnaires regarding demographic characteristics and previous/current pitching-related elbow pain. Head-neck rotation, upper- and lower-limb ROM, and thoracic kyphosis were measured. Binomial logistic regression was used to identify factors associated with elbow pain history.	Head-neck rotation ROM; pitching-related elbow pain; shoulder ROM; thoracic kyphosis; demographic and playing characteristics.	Players with a history of pitching-related elbow pain had significantly lower non-dominant head-neck rotation (74.9° ± 9° vs 77.7° ± 9.6°; p=0.02) and overall head-neck rotation (150.6° ± 14.7° vs 154.9° ± 18.4°; p=0.04). Non-dominant head-neck rotation, dominant shoulder horizontal adduction, height, and playing position were associated with elbow-pain history.
6. Preseason Neck Mobility Is Associated With Throwing-Related Shoulder and Elbow Injuries, Pain, and Disability in College Baseball Pitchers	Cohort study involving 49 college baseball pitchers (mean age 19.92 ± 1.48 years). Preseason posture, neck mobility, and shoulder passive ROM were assessed. Participants were followed during the season for time-loss shoulder/elbow injuries and disability. Risk ratios and time-to-injury analysis were performed.	Cervical Flexion-Rotation Test (CFRT); cervical ROM; shoulder passive ROM; time-loss shoulder/elbow injury; Functional Arm Scale for Throwers (FAST).	10 pitchers (20.4%) sustained a time-loss shoulder/elbow injury lasting >7 days. A dominant-side CFRT ≤39° was associated with more than 9-fold increased risk of time-loss injury (RR=9.38; 95% CI 1.28–68.49). Reduced CFRT and cervical flexion ROM were also associated with increased pain and disability.
7. Symmetry of the Neck Muscles'	Observational electromyographic study	Bilateral upper trapezius and	At rest, muscle activity was 23.74% higher on the left

Topic / Article Name	Methodology	Outcome Measures	Results
Activity in the Electromyography Signal During Basic Motion Patterns	involving 18 participants . Surface EMG was recorded bilaterally from the upper trapezius and sternocleidomastoid muscles during rest, maximum voluntary contraction, and six functional neck movements. Muscle activity was normalized to MVC and a Symmetry Index was calculated.	sternocleidomastoid muscle activity; muscle activation symmetry; Symmetry Index during neck movements.	for upper trapezius and 27.88% higher for sternocleidomastoid. The greatest asymmetry occurred in sternocleidomastoid during right-arc movement (116%) and upper trapezius during lower-arc movement (55%). Extension-flexion showed the lowest asymmetry.
8. Unilateral and Ipsilateral Strength Asymmetries in Elite Youth Soccer Players With Respect to Muscle Group and Limb Dominance	Observational study involving 41 elite U16 national-team soccer players (mean age 15.7 ± 0.3 years). Concentric knee flexor and extensor strength was assessed using a Cybox Humac Norm isokinetic dynamometer at different velocities. Bilateral and ipsilateral strength asymmetries were analyzed according to limb dominance.	Bilateral quadriceps and hamstring strength asymmetry; ipsilateral strength ratio; dominant vs non-dominant limb differences.	More than 73.2% of players demonstrated at least one strength asymmetry . Knee-flexor asymmetries were greater than knee-extensor asymmetries. Strength asymmetry $>10\%$ was observed in 36.6–51.2% of knee flexors and 19.5–31.7% of knee extensors . The non-dominant limb showed a higher percentage of asymmetry than the dominant limb, although the difference was not statistically significant.

Results

The present narrative review included eight selected studies examining biomechanical factors, strength, movement characteristics, and rehabilitation-related considerations relevant to twisting and rotational demands in shot put and other throwing athletes. The available evidence included randomized controlled trials, observational studies, reliability studies, cross-sectional studies, and cohort research.

Among the studies directly involving shot put athletes, kinematic-chain training was associated with improvements in throwing distance and shoulder muscle strength following an eight-week training programme. The findings suggest that coordinated training of the lower limb, trunk, and upper limb may contribute to improved force transmission during the throwing movement. Video-based analysis of collegiate shot-put athletes also demonstrated differences between glide and rotational techniques, with the glide technique showing greater throwing velocity and distance in the reported sample.

Studies involving throwing and overhead athletes provided additional information regarding factors that may influence injury risk. Reduced cervical rotation and restricted neck mobility were associated with a history of throwing-related elbow problems and an increased occurrence of shoulder or elbow injuries among baseball players. These findings indicate that movement restrictions outside the shoulder itself may influence the overall mechanics of throwing activities.

The reliability study involving the seated shot-put test demonstrated good-to-excellent test-retest reliability for several testing positions, supporting the usefulness of shot-put-type functional testing for evaluating upper-limb performance. In addition, the studies examining neck-muscle activity and lower-limb strength asymmetry demonstrated that muscular asymmetry can occur in athletic populations. Overall, the reviewed literature indicates that rotational performance is influenced by the interaction of strength, mobility, neuromuscular control, and coordination rather than by a single physical factor.

Discussion

The findings of this narrative review indicate that shot put is a highly coordinated movement in which force must be transferred through multiple body segments. Although direct research specifically investigating physiotherapy management of twisting injuries in shot put athletes was limited, the available literature provides useful information from shot-put and related throwing populations.

The improvement in throwing performance following kinematic-chain training highlights the importance of considering the entire kinetic chain during rehabilitation. The throwing action does not depend solely on the shoulder or arm. Force generated by the lower extremities must be transferred through the pelvis and trunk before reaching the upper limb. Consequently, weakness or poor coordination at one segment may alter movement at another segment and potentially increase mechanical stress.

The comparison of shot-put techniques also emphasizes the importance of technique-specific assessment. Glide and rotational techniques involve different movement strategies and may place different demands on the lower limb, pelvis, trunk, and upper limb. Therefore, physiotherapists should assess the athlete's individual technique rather than applying an identical rehabilitation programme to every shot-put athlete. Evidence from baseball players provides supporting information regarding the role of cervical mobility in throwing activities. Reduced cervical rotation was associated with throwing-related elbow problems and shoulder or elbow injuries in the reviewed studies. Although baseball pitching and shot putting are not identical activities, both require coordinated trunk and upper-body rotation. Therefore, cervical and thoracic mobility may be considered during a comprehensive physiotherapy assessment, while recognizing that the findings cannot be directly assumed to represent shot-put athletes.

The findings related to muscular asymmetry are also relevant to rehabilitation planning. Athletic movements involving repeated unilateral loading can produce differences in strength and muscle activation between limbs. Rather than considering every asymmetry as pathological, physiotherapists should determine whether an observed difference is associated with pain, reduced performance, altered movement patterns, or insufficient functional capacity.

From a physiotherapy perspective, assessment should therefore include pain evaluation, range of motion, muscle strength, flexibility, trunk and pelvic control, lower-limb function, cervical and thoracic mobility, movement coordination, and sport-specific technique. Rehabilitation can then progress from basic mobility and strength exercises toward integrated kinetic-chain and sport-specific activities.

A progressive rehabilitation programme may include mobility exercises, core and pelvic stabilization, lower- and upper-limb strengthening, neuromuscular control exercises, balance training, rotational control exercises, and gradual exposure to throwing-specific loads. Once adequate strength and movement control are achieved, sport-specific drills can be incorporated progressively before unrestricted return to competition.

An important limitation of the available evidence is the lack of studies directly examining physiotherapy treatment of twisting injuries specifically in shot-put athletes. Several studies included in this review involved baseball players, overhead athletes, soccer players, or general athletic populations. Therefore, their findings should be regarded as **supporting evidence rather than direct evidence for shot-put injury management**. Further research involving larger samples of shot-put athletes is needed to determine which rehabilitation and injury-prevention strategies are most effective for this population.

Conclusion

The available literature suggests that twisting and rotational demands in shot put should be considered from a **whole kinetic-chain perspective**. Strength, mobility, neuromuscular control, movement coordination, and sport-specific technique may all contribute to efficient throwing mechanics and appropriate load distribution.

Physiotherapy management should therefore extend beyond treatment of the painful region and include assessment and rehabilitation of the lower limb, pelvis, trunk, cervical and thoracic regions, and upper limb. Progressive strengthening, mobility training, rotational control, kinetic-chain exercises, technique-specific training, and gradual return to throwing may form important components of rehabilitation.

However, because direct evidence concerning twisting injuries in shot-put athletes remains limited, recommendations derived from other throwing and athletic populations should be applied cautiously. Future research should specifically investigate the incidence, mechanisms, rehabilitation, and prevention of rotational injuries in shot-put athletes.

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