

Study of Closed Kinetic Chain Upper Extremity Function in Cricketers

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ABSTRACT

Background and Purpose: Playing cricket requires upper extremity strength and endurance, adequate scapular control and co-ordinated movements of the upper kinetic chain for optimal function and performance.

Methodology: A cross-sectional study was conducted in 86 male cricketers in the age group of 18 to 25 years. The Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST) is an assessment tool for upper limb function and stability. The normalized score and power score was calculated.

Results: Out of 86 cricketers, 48 (55.81%) were batsmen and 38 (44.19%) were bowlers. The mean age of the batsmen and bowlers were 23.89 ± 2.71 and 22.41 ± 2.23 years respectively. The comparison of mean value of CKCUEST average score between bowlers and batsmen using independent t test was statistically insignificant ($p = 0.119$). Also, the comparison of mean value of CKCUEST average score between bowlers and batsmen using independent t test was statistically insignificant ($p = 0.707$).

Conclusion: The reference values of the CKCUEST for cricket players were studied. The study showed that there was no significant difference in mean values of CKCUEST average and power score in cricketers with respect to their player position.

Key words: cricket, closed kinetic chain upper extremity stability test, shoulder joint.

INTRODUCTION

Cricket, a batting and bowling game, requires the implementation of an intricate sequence of actions which requires high level skill and fitness. [1] Excellent upper extremity strength and endurance, hand grip strength, adequate scapular control and co-ordinated function of the upper kinetic chain are essential for optimal function and performance in cricketers. Studies reveal upper limb injuries are very common in these players because of their involvement in strenuous activities like bowling, throwing, fielding and batting.

A recently published study in India showed that 16.8% upper limb injuries

prevalence was seen in professional cricket players. [2] Also, research revealed that shoulder injury was more frequent among fielders and bowlers which had a negative impact on their performance. [3] Repetitive forceful ballistic arm movements incorporated during playing technique leads to increase in eccentric load on the shoulder complex muscles affecting their length tension relationship and predisposing to injuries. [4]

Playing cricket places stress on the upper extremity which necessitates that the athlete must have adequate strength, stability, and mobility in upper kinetic chain. Functional performance testing

incorporates application of task or sports specific maneuvers allowing the clinician to qualitatively and/or quantitatively assess a person's performance of a specific task. It assists to depict dynamic physical function of an athlete.^[5] The Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST) is an assessment tool for upper limb function and stability. It is easy to administer, cost effective, easily understood and has been validated by the peak torque of internal/external shoulder rotation (isokinetic dynamometer) and maximum grip strength (hand dynamometer).^[6,7]

The CKCUEST was found to be reliable in asymptomatic subjects and subjects with subacromial impingement syndrome with test/re-test reliability being reported as excellent ($ICC \geq 0.91$).^[8,9] This test involves counting how many times the subject performs alternating touches on the opposite hand in a push up – a closed kinetic chain position over time period of 15 seconds, with three trials. The purpose of this study was to establish reference values for the CKCUEST in the cricketers. A secondary objective was to determine if there were differences in CKCUEST scores based on playing position.

MATERIALS & METHODS

A cross-sectional study was conducted after obtaining approval from the Institutional Research Review Committee (IERC). Eighty-six male cricketers in the age group of 18 to 25 years were selected as per the inclusion and exclusion criteria. Cricketers who are currently playing for more than 1 year were recruited. Exclusion criteria included any upper extremity or spine pain or injury within the previous 6 months, history of any shoulder surgery or current illness. Subjects were explained about the purpose of the study in the language best understood by them. Written informed consent was taken from the subjects who were willing to participate in the study. The study protocol was completed in one session for each subject. The demographic information of

participants, such as, age, dominance and player characteristic was recorded.

The CKCUEST was performed as per the protocol given by Tucci et al.^[9] The starting position was push up with both hands positioned on two pieces of tape affixed to the ground at a distance of 91.4 cm apart. The participant alternatively touched the opposite hand for a time frame of 15 seconds while remaining in push up position. Each subject was allowed to perform the test once as a trial in order to familiarize themselves with the task before the actual test. Three repetitions of the 15-second CKCUEST were performed with an interval of 45 seconds between each test. The average touches score was calculated on the basis of the arithmetic mean number of touches recorded during the three attempts. The normalized score, the score was calculated by dividing the average number of touches by the subject's height in meters. The power score was obtained by the product of the average number of touches and 68% of body weight in kilograms divided by 15.^[10]

Statistical Analysis:

Data were analyzed using SPSS version 20 (Statistical Package for Social Science). Mean and standard deviation values were determined for all continuous variables. The comparison of scores of closed kinetic chain upper extremity stability test was analyzed using Independent t test. P value less than 0.05 was considered as statistically significant.

RESULTS

The present study was conducted in 86 cricket players in the age group of 18 to 25 years. Out of which 48 (55.81%) were batsmen and 38 (44.19%) were bowlers. The mean age of the batsmen and bowlers was 23.89 ± 2.71 and 22.41 ± 2.23 years respectively. Table 1 shows the characteristics of the cricket players with respect to batsmen and bowlers including age, height, weight, body mass index and playing experience. The mean values

CKCUEST average and power score are depicted in Table 2. The comparison of mean value of CKCUEST average score between bowlers and batsmen using independent t test was statistically

insignificant (p=0.119). Also, the comparison of mean value of CKCUEST average score between bowlers and batsmen using independent t test was statistically insignificant (p = 0.707).

Table 1. Characteristics of the cricket players.

Characteristics of the cricket players	Batsmen (N = 48)	Bowler (N = 38)
	Mean ± Standard deviation	Mean ± Standard deviation
Age (in years)	23.89 ± 2.71	22.41 ± 2.23
Height (in cm)	170.33 ± 10.23	171.66 ± 8.86
Weight (in kg)	60.33 ± 11.07	60.24 ± 9.32
Body mass index (in kg/m ²)	21.04 ± 3.14	23.47 ± 3.59
Playing experience (in years)	3.2 ± 1.7	2.79 ± 1.5

Table 2. Comparison of mean values of CKCUEST scores with respect to the cricket player position.

Variables	Batsmen (N = 48)	Bowler (N = 38)	Independent t test
	Mean ± Standard deviation	Mean ± Standard deviation	p value
CKCUEST average score	21.88 ± 3.57	23.26 ± 4.61	0.119
CKCUEST power score	61.59 ± 14.03	62.81 ± 15.87	0.707

*p value is significant at < 0.05.

DISCUSSION

Shoulder joint, a ball and socket variety of joint, provides larger mobility as compared to stability. Overhead activities, fielding and bowling require larger arc of motion at the shoulder joint which leads to increased stress on the shoulder complex structures and makes the cricket player susceptible to the injury. [11, 12] Upper quarter injuries are observed to be common in cricket players and are attributed to risk factors like playing technique, anthropometric measures, strength, endurance and skill. [2] Optimal shoulder function requires interaction between glenohumeral joint and scapulothoracic joint, muscle strength, range of motion, motor control and kinetic chain function. Also, integrity of the rotator cuff muscles and capsular structures must be intact in order to serve a stable center of rotation during the throwing motion. [13]

Functional performance testing provides qualitative and quantitative assessment that assists to assess an individual task with respect to sport specific movements. Closed Kinetic Chain testing is a technique employed by clinicians to evaluate optimal stability, proprioception and motor control of the shoulder complex. [14] This technique is cost-effective, easy to

perform and understood by the individual. [9] The major concern with respect to the CKCUEST was the excessive force placed on the wrist, elbow and shoulder joint which can be detrimental in case multiple injury to the upper extremity and can lead to re-injury and hamper the prognosis. [6] Previous studies reported 22.5±4.3 touches as reference values of the CKCUEST in division I collegiate football players and 30.41±3.87 touches in collegiate baseball players. [6, 15] The current study reported the CKCUEST average score and power score for the batsmen were 21.88±3.57 and 61.59±14.03 respectively. Whereas, the CKCUEST average score and power score for the bowler were 23.26±4.61 and 62.81 ± 15.87 respectively.

Closed kinetic chain testing can also be incorporated as a part of post injury rehabilitation and assessment to determine the stability and upper extremity function and return to sport of the injured player. Closed-kinetic chain exercises help to improve the joint stability, proprioception, multiple muscle group activation and enhance motor control. [16, 17] A review of literature shows that incorporation of upper limb weight bearing exercises augment muscular co-contraction of the glenohumeral joint through joint

compression and approximation. [18] Commonly, in the clinical practice, open-kinetic chain assessment of the upper extremity like strength, stability, proprioception and range of motion is performed. Although these tests are important, assessment of these variables only assesses a fraction of function. Inclusion of closed-kinetic chain assessments will assist in holistic approach towards evaluation and rehabilitation of the upper limb. [19, 20]

CONCLUSION

The reference values of the CKCUEST for cricket players were studied. The study showed that there was no significant difference in mean values of CKCUEST average and power score in cricketers with respect to their player position.

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REFERENCES

1. Cotterill, S. Experiences of developing preperformance routines with elite cricket players. *Journal of Sport Psychology in Action*. 2011; 2, 81–91.
2. Dhillon MS, Garg B, Soni RK, Dhillon H, Prabhakar S. Nature and incidence of upper limb injuries in professional cricket players: a prospective observation. *Sports Med Arthrosc Rehabil Ther Technol*. 2012; 4:42.
3. Ranson C, Gregory PL. Shoulder injury in professional cricketers. *Phys Ther Sport*. 2008; 9:34-39.
4. Stretch, R.A. Incidence and nature of epidemiological injuries to elite South African cricket players. *S. Afr. Med*. 2001; 91: 336-9.
5. Keskula DR, Duncan JB, Davis VL, Finley PW. Functional outcome measures for knee dysfunction assessment. *J Athl Train*. 1996; 31(2):105-110.
6. Roush JR, Kitamura J, Waits MC. Reference values for the closed kinetic chain upper extremity stability test (CKCUEST) for collegiate baseball players. *North Am J Sport Phys Ther*. 2007; 2(3):159–63.
7. Lee D-R, Kim LJ. Reliability and validity of the closed kinetic chain upper extremity stability test. *J PhysTher Sci*. 2015; 27(4): 1071–3.
8. Goldbeck TG, Davies G. Test-retest reliability of the closed chain upper extremity stability test: A clinical field test. *J Sport Rehabil*. 2000;9:35-45.
9. Tucci HT, Martins J, de Carvalho Sposito G, Ferreira Camarini PM, de Oliveira AS. Closed Kinetic Chain Upper Extremity Stability test (CKCUES test): a reliability study in persons with and without shoulder impingement syndrome. *BMC Musculoskeletal Disorders*. 2014; 15:1-9.
10. Ellenbecker TS, Manske R, Davies GD. Closed kinetic chain testing techniques of upper extremities. *Orthop Phys Ther Clin North Am*. 2000;9 (Suppl 2):19-29
11. Stevenson, J.H. and T. Troijan, Evaluation of shoulder pain. *The journal of family practice*, 2002.
12. Gerber, C. and A. Sebesta, Impingement of the deep surface of the subscapularis tendon and the reflection pulley on the anterosuperior glenoid rim: a preliminary report. *J Shoulder Elbow Surg*, 2000. 9(6): p. 483-90.
13. Van der Hoeven, H. and W.B. Kibler, Shoulder injuries in tennis players. *Br J Sports Med*, 2006. 40(5): p. 435-40; discussion 440.
14. De Oliveira, V., Pitangui, A., Nascimento, V., Da Silva, H., Dos Passos, M., & De Araujo, R. Test-retest reliability of the closed kinetic chain upper extremity stability test (CKCUEST) in adolescents: reliability of CKCUEST in adolescents. *International Journal of Sports Physical Therapy*. 2017; 12(1), 125-132.
15. Pontillo, M., B.A. Spinelli, and B.J. Sennett, Prediction of in-season shoulder injury from preseason testing in division I collegiate football players. *Sports Health*, 2014. 6(6): p. 497503.
16. McGee C, Kersting E, Davies GJ, McLean KP. Standard rehabilitation vs. standard plus closed kinetic chain rehabilitation for patients with shoulder impingement: A rehabilitation outcomes study. *UW-L Journal of Undergraduate Research*. 1998; 1:103-113.

17. Heiderscheit BC, Rucinski TJ. Biomechanical and physiologic basis of closed kinetic chain exercises in the upper extremities. *Orthopaedic Physical Therapy Clinics of North America*. 2000; 9:209-218.
18. Hirashima M, Kadota H, Sakurai S, et al. Sequential muscle activity and its functional role in the upper extremity and trunk during overarm throwing. *J Sports Sci*. 2002; 20:301-310.
19. Tritschler, K. Barrow and McGee's Practical Measurement and Assessment. 5th ed. Philadelphia: Lippincott, Williams, & Wilkins; 2000.
20. Wilk KE, Arrigo CA, Andrews JR. Closed and open kinetic chain exercise for the upper extremity. *Journal of Sport Rehabilitation*. 1996; 5:88-102.

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