



## STRENGTH AND CONDITIONING CONSIDERATIONS FOR THE ELITE TEN-PIN BOWLER

JULIAN LIM, MS, CSCS

**T**en-pin bowling is an international indoor sport that has gained participation both at the recreational and elite levels. Its popularity has enabled the sport to be featured in the Commonwealth and Asian Games since 1998 and 1978, respectively. It is commonly viewed that ten-pin bowling is not a physically demanding sport (5,6). However, recent studies have shown that a significant amount of muscular strength and endurance is correlated with high performance in the sport of ten-pin bowling (3,4).

### FIVE-STEP APPROACH

The five-step approach (Figure 1) in ten-pin bowling delivery is the choice movement used by most elite bowlers around the world. A proper five-step approach can result in greater ball speed at release. This article focuses on strength and conditioning considerations that impact performance of this specific movement.

### POWER-STEP

The power-step is the penultimate step used in the five-step approach, and its goal is to assist the bowler in generating more power in the approach. In a right-handed bowler, this requires a quick and forceful extension of the right hip and knee joints. Peak horizontal ground reaction force and impulse need to be generated to initiate the transfer of forces from the ground to the ball at the point of release from the bowler's hand.

### BOWLING DELIVERY

The delivery of the bowling ball occurs during the last step of the five-step approach. As the left foot is sliding, the bowling ball is released when the arm swing reaches the bottom of its arc. Simultaneously, the bowler's fingers lift upward and outward to impart revolution on the bowling ball. The efficiency of the movement is influenced by arm flexion and forearm internal rotation. Strength of the arm flexors and forearm/wrist internal rotators are significantly correlated with ball release velocity, but not to average bowling score (2). Researchers also reported that experienced players generate tremendous spin on the bowling ball, and thus develop strong forearm/wrist rotators through experience (2).

### INJURY PREVENTION

Oftentimes, bowlers' shoulders can be susceptible to chronic injuries. Instead of letting the arm swing like a pendulum through the delivery, many contemporary bowlers attempt to "muscle" through the shot. Not only does this place high traction force on the glenohumeral joint, and may possibly lead to injury, the anterior shoulder muscles can also become overdeveloped, in comparison to the opposing muscle group. Therefore, it seems beneficial for elite ten-pin bowlers to strengthen the posterior shoulder muscles to help reduce such incidence of muscular injuries and imbalances.

Injuries to the lower back may also occur during the backswing of the bowling delivery. The higher the backswing, the greater the potential momentum generated for acceleration of the subsequent bowling delivery. A lack of extension and rotation of the thoracic spine and glenohumeral joint can affect the peak height of the backswing. To achieve the desired range of the backswing, the lumbar spine has to compensate with extension and rotation movements. This may potentially lead to the development of chronic injuries to the lower back. Thus, optimal thoracic and shoulder mobility is suggested to achieve safe and efficient technique for the backswing.

Injuries to the lower limbs may occur if a bowler lacks the ability to form a stable base during the approach. Inefficient bowlers often display noticeable knee valgus/varus movements on the last step just before the point of release (1). The improper gait during the approach and slide may lead to adductor muscle strains and knee ligament injuries (1). Increasing lower body strength, especially in the muscles involved in hip stability, appears beneficial to help decelerate the body and maintain knee and ankle alignment, as the bowler “slides” at the end of the approach.

### SAMPLE BOWLING TRAINING PROGRAM

Table 1 shows a sample strength and conditioning program for an elite bowler. The training program is mainly comprised of training for the muscles involved in the bowling delivery. These include strengthening the gluteus maximus and hamstring musculature for horizontal force propulsion during the power-step phase. In addition, this program also includes exercises for the biceps brachii and internal rotators of the forearm muscles for effective bowling ball release during the delivery.

Prehabilitation (i.e., injury prevention) exercises are included to address scapular stabilization and thoracic mobility during the backswing, as well as hip stabilization during the sliding phase of the delivery. These exercises are performed between sets of the main exercises.

Lastly, core stability exercises are included to increase endurance and dynamic stabilization to help in maintaining optimal technique during the bowling delivery (Table 2). Exercises that focus on anti-rotation, anti-extension, and anti-flexion movement patterns are included in this program.

### CONCLUSION

The modern game of ten-pin bowling requires an athlete to have high levels of physical preparedness to excel. By implementing the sample training program, an athlete may be able to improve performance in the sport of ten-pin bowling.

### REFERENCES

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### ABOUT THE AUTHOR

*Julian Lim is a strength and conditioning coach at the Singapore Sports Institute, where he implements sport-specific training programs for national and elite level athletes. His current portfolio includes athletes competing in athletics, badminton, basketball, and bowling. He endeavors to research and utilize evidence-based strength training principles to enhance an athlete's sporting performance. Lim received his Bachelor's degree in Sports Science from Edith Cowan University and his Master's degree in Research from the National Institute of Education in Singapore.*

## STRENGTH AND CONDITIONING CONSIDERATIONS FOR THE ELITE TEN-PIN BOWLER

**Five-Step Approach (Figure 1):** With a five-step approach, step 1 is short. The bowler moves the ball forward on step 2, begins the drop on 3, and reaches the height of the backswing on step 4. The ball comes forward on step 5, into a long slide and straight-arm release.



FIGURE 1. FIVE-STEP APPROACH

**Forward Mini-Hurdle Hop to Single-Leg Landing (Figure 2):** A) From an athletic position, explosively jump over the mini-hurdle. B) Prepare to land in a single-leg stance while in mid-air. C) Absorb the landing on one leg by flexing the hip, knee, and ankle. Stay in the landing position for 1 s.



FIGURE 2. FORWARD MINI-HURDLE HOP TO SINGLE-LEG LANDING

**Barbell Skater Squat (Figure 3):** A) While standing upright with a barbell across the upper back, shift into a single-leg stance. B) Slowly extend one leg behind the body while maintaining a neutral spine. The trail leg should not be in contact with the ground at any time.



FIGURE 3. BARBELL SKATER SQUAT

**Single-Leg Glute Bridge (Figure 4):** A) Begin in a supine position with the lower back slightly pressed against the ground (posterior pelvic tilt), one leg in the air, and the other leg planted on the ground or diagonal surface. B) Initiate the hip extension with the weight on the heel of the foot. Finish the whole movement with plantar flexion of the same foot.



FIGURE 4. SINGLE-LEG GLUTE BRIDGE

**Forearm Pronation (with band) (Figure 5):** A) Attach the end of a weighted handle to resistance tubing, and secure the tubing to an anchor point. Ensure that the forearm is parallel to the floor at the start of the movement. B) Rotate the forearm and ensure that sufficient tension is applied to the resistance tubing as the handle is positioned perpendicular to the floor. Throughout the movement, ensure that the elbow of the pronating arm is held still and beside the body as best as possible.

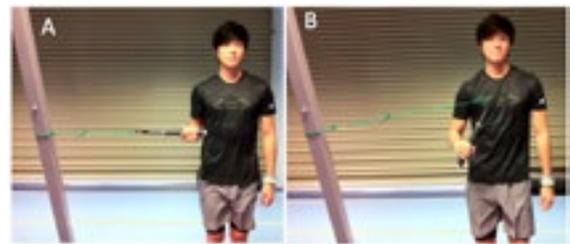


FIGURE 5. FOREARM PRONATION (WITH BAND)

**Pretzel Stretch (Figure 6):** Hold down the position of the right knee onto the ground with the left hand. Then, place the right hand on the left ankle to pull the shoulder across the body in the opposite direction. Hold this position before switching to the opposite side.



FIGURE 6. PRETZEL STRETCH

TABLE 1. SAMPLE STRENGTH AND CONDITIONING PROGRAM FOR BOWLERS

| EXERCISE  | SETS X REPETITIONS | LOAD           | REST      | PREHABILITATION EXERCISE BETWEEN SETS     |
|---|--------------------|----------------|-----------|---|
| Forward mini-hurdle hops to single-leg landing (Figure 2) | 3 x 10             | Body mass      | 2 – 3 min |   |
| Barbell skater squats (Figure 3)                          | 4 x 6              | < 67% 1RM      | 30 – 60 s | Monster walks with bands                  |
| Single-arm dumbbell rows                                  | 4 x 6              | < 67% 1RM      | 30 – 60 s | “T” and “I” exercises (with weight plate) |
| Single-leg glute bridges (Figure 4)                       | 4 x 10             | Body mass      | 30 – 60 s | Pretzel stretch (Figure 6)                |
| Forearm pronation (with band) (Figure 5)                  | 3 x 10             | Self-regulated | 30 – 60 s |   |

TABLE 2. SAMPLE CORE STABILITY PROGRAM FOR BOWLERS

| EXERCISE       | SETS X REPETITIONS | FOCUS OF EXERCISE       |
|----------------|--------------------|-------------------------|
| Back extension | 2 x 15             | Anti-flexion            |
| Dead bug       | 2 x 10 (each side) | Anti-extension/rotation |
| Bird dog       | 2 x 10 (each side) | Anti-flexion/rotation   |
| Side plank     | 2 x 45 – 60 s      | Anti-lateral flexion    |