

# Interval Throwing and Hitting Programs in Baseball: Biomechanics and Rehabilitation

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## Abstract

Baseball injuries from throwing and hitting generally occur as a consequence of the repetitive and high-energy motions inherent to the sport. Biomechanical studies have contributed to understanding the pathomechanics leading to injury and to the development of rehabilitation programs. Interval-based throwing and hitting programs are designed to return an athlete to competition through a gradual progression of sport-specific exercises. Proper warm-up and strict adherence to the program allows the athlete to return as quickly and safely as possible.

Throwing and batting each require repetitive motions that can result in injuries unique to baseball. Fortunately, advances in operative and nonoperative treatments have allowed players to return to competition after sustaining what previously would have been considered a career-ending injury. Once a player has been deemed ready to return to throwing or hitting, a comprehensive, multiphased approach to rehabilitation is necessary to reintroduce the athlete back to baseball activities and avoid re-injury. This article reviews the biomechanics of both throwing and hitting, and outlines the phases of rehabilitation necessary to allow the athlete to return to competition.

## Throwing

### Biomechanical Overview

The overhead throwing motion is complex and involves full body coordination from the initial force generation through the follow-through phase of throwing. The “kinetic chain”—the concept that

movements in the body are connected through segments culminating with the highest energy in the final segment—is paramount to achieving the force and energy needed for throwing.<sup>1-8</sup> The kinetic chain begins in the lower body and trunk and transmits the energy distally to the shoulder, elbow, and hand, ending with kinetic energy transfer to the ball.<sup>3-5,7</sup> The progression of motion through the kinetic chain during throwing includes stride, pelvis rotation, upper torso rotation, elbow extension, shoulder internal rotation, and wrist flexion. Disruptions in this chain due to muscle imbalance or weakness can lead to injury downstream, particularly in the upper extremity.<sup>3,7,9</sup> The importance of the kinetic chain can be highlighted in the 6 phases of throwing motion. These include wind-up, early arm cocking, late arm cocking, arm acceleration, arm deceleration, and follow-through (**Figure 1**).<sup>1,2,9,10</sup>

The wind-up phase starts with initiation of motion and ends with maximal knee lift of the lead leg; its objective is to place the body in an optimal stance to throw.<sup>3-5,7</sup> There are minimal forces, torques, and muscle activity in the upper extremity during this phase, but up to 50% of throw speed is created through stride and trunk rotation.<sup>6</sup> During the early cocking phase, the thrower keeps his stance foot planted and drives his lead leg towards the target, while bringing both arms into abduction. This is coupled with internal rotation of the stance hip, external rotation of the lead hip, and external rotation of the throwing shoulder. This creates linear velocity by maximizing the length of the elastic components of the body. Elbow, wrist, and finger extensors are also contracting during this phase to control elbow flexion and wrist hyperextension.<sup>3</sup>

The late cocking phase begins when the lead foot contacts the ground and ends with maximum shoulder external rotation.<sup>3-5</sup> Lead foot contact is followed by quadriceps contraction to deceler-

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ate and stabilize the lead leg. This is followed by rotation of the pelvis and upper torso. The result is energy transfer to the throwing arm with a shear force across the anterior shoulder of 400 N.<sup>4</sup> The shoulder stays in 90° of abduction, 15° of horizontal adduction, and externally rotates to between 150° and 180°. This produces a maximum horizontal adduction moment of 100 N·m and internal rotation torque of 70 N·m.<sup>4</sup> Simultaneously, the elbow generates maximum flexion and a 65 N·m varus torque.<sup>7</sup> Forces about the elbow are generated to resist the large angular velocity experienced (up to 3000°/second). This places an extreme amount of valgus stress along the medial elbow, particularly on the ulnar collateral ligament. The shoulder girdle and rotator cuff muscles simultaneously act to stabilize the scapula and glenohumeral joint.

The arm acceleration phase is from maximal shoulder external rotation until ball release.<sup>3,5</sup> In this phase, the thrower flexes his trunk from an extended position, returning to neutral by the time of ball release while the lead leg straightens. The shoulder stays abducted at 90° throughout while the rotator cuff internal rotators and scapular stabilizers contract to explosively internally rotate the shoulder, creating a maximal internal rotation velocity greater than 7000°/second by ball release.<sup>1,4,7</sup> The elbow also begins to extend, reaching maximum velocity during mid-acceleration phase from a combination of triceps contraction and torque generated from rotation at the shoulder and upper trunk.<sup>3</sup> Finally, the wrist flexors contract to move the wrist to a neutral position from hyperextension as the ball is released.

During arm deceleration, the shoulder achieves maximum internal rotation until reaching a neutral position and horizontally adducts across the body. This is controlled by contraction of the shoulder

girdle musculature; the teres minor has the highest activity.<sup>3,4</sup> The greatest forces produced during the throwing motion act at the shoulder and elbow during deceleration and can contribute to injury.<sup>2</sup> These include compressive forces of greater than 1000 N, posterior shear forces of 400 N, and inferior shear forces of 300 N.<sup>4,7</sup>

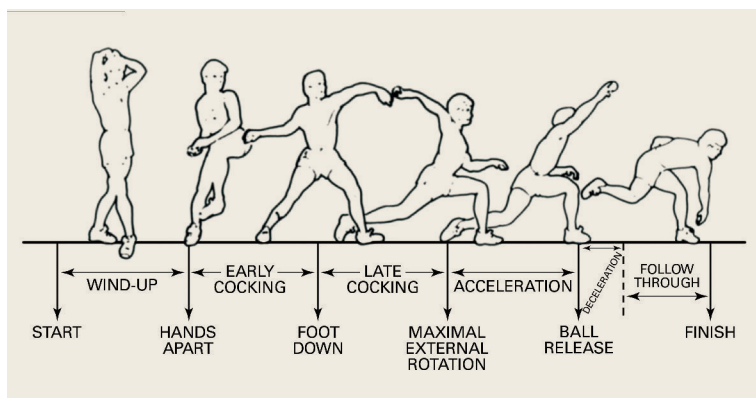
The final phase, the follow-through phase, starts at shoulder maximum internal rotation and ends when the arm assumes a balanced position across the trunk. Lower extremity extension and trunk flexion help distribute forces throughout the body, taking stress away from the throwing arm. The posterior shoulder musculature and scapular protractors contribute to continued deceleration and muscle firing returns to resting levels. This complex motion of throwing fueled by the kinetic chain lasts less than 2 seconds and can result in ball release speeds as high as 100 miles per hour.<sup>3,4</sup>

## Return to Throwing: Principles

Nonoperative and postoperative rehabilitation programs allow restoration of motion, strength, static and dynamic stability, and neuromuscular control. The initiation of an interval throwing program (ITP) is based on the assumption that tissue healing is complete and a complete physical examination has been conducted to the treating physician's approval.<sup>11</sup> An ITP progressively applies forces along the kinetic chain in a controlled manner through graduated throwing distances, while minimizing the risk of re-injury.

Reinold and colleagues<sup>12</sup> described guidelines that were used in the development of the ITP.<sup>12</sup> These factors include: (1) The act of throwing a baseball involves the transfer of energy from the feet up to the hand and therefore careful attention must be paid along the entire kinetic chain; (2) gradual progression of interval throwing decreases the chance for re-injury; (3) proper warm-up; and (4) proper throwing mechanics minimizes the chance of re-injury.

**Variability.** Unlike traditional rehabilitation programs that advance an athlete based on a specific timetable, the ITP requires that each level or phase to be completed pain-free or without complications prior to starting the next level. Therefore, an ITP can be used for overhead athletes of varying skill levels because progression will be different from one athlete to another. It is also important to have the athlete adhere strictly to the program, as over-eagerness to complete the ITP as quickly as possible can increase the chance of re-injury and



**Figure 1.** Six phases of overhead throwing.

Reprinted with permission from *J Shoulder Elbow Surg*.<sup>10</sup>

thus slow the rehabilitation process.<sup>12</sup>

**Warm-up.** An adequate warm-up is recommended prior to initiating ITP. An athlete should jog or cycle to develop a light sweat and then progress to stretching and flexibility exercises. As emphasized before, throwing involves nearly all the muscles in the body. Therefore, all muscle groups should be stretched beginning with the legs and working distally along the kinetic chain.

**Mechanics.** Analysis, correction, and maintenance of proper throwing mechanics is essential throughout the early phases of rehabilitation and ITP. Improper pitching mechanics places increased stress on the throwing arm, potentially leading to re-injury. Therefore, it would be valuable to have a pitching coach available to emphasize proper mechanics throughout the rehabilitation process.

### **The Interval Throwing Program**

For a PDF patient handout that summarizes the phases of this program, see **Appendix 1** online at [www.amjorthopedics.com](http://www.amjorthopedics.com).

**Phase 1.** We have adopted the ITP as described by Reinold and colleagues.<sup>12</sup> Phase begins with the overhead athlete throwing on flat ground. He or she begins tossing from 45 feet and gradually progresses to 60, 90, 120, 150, and 180 feet.

As discussed earlier, it is critical to use proper mechanics throughout the ITP. The “crow hop” method simulates a throwing act and helps maintain proper pitching mechanics. Crow hop has 3 components: hop, skip, and throw. Using this technique, the pitcher begins warm-up throws at a comfortable distance (generally 30 feet) and then progresses to the distance as indicated on the ITP. The athlete will then need to perform each step 2 times, with 1 day of rest between steps, before advancing to the next step. The ball should be thrown with an arc and have only enough momentum to reach the desired distance.

For example, Step 1 calls for the athlete to perform 2 sets of 25 throws at 45 feet, with adequate rest (5 minutes) between sets. This step will be repeated following 1 day of rest. If the athlete demonstrates the ability to throw at the prescribed distance without pain, he or she can progress to Step 2, which calls for 3 sets of 25 throws at 45 feet. If pain is present at any step, the thrower returns to the previous asymptomatic step and can progress once he is pain-free.

Positional players are instructed to complete Phase 1 prior to starting position-specific drills. Pitchers, on the other hand, are instructed to stop

once they reach and complete 120 feet. They will then progress to tossing at progressive distances of 60, 90, and 120 feet, followed by throwing at 60 feet 6 inches with normal pitching mechanics, initiating straight line throws with little to no arc.

**Phase II (Throwing off the Mound).** Once a pitcher completes Phase 1 without pain or complications, he is ready to begin throwing off the mound. The same principle remains in Phase 2: pitchers must complete each step pain-free before advancing to the next stage. Pitchers should first throw fastballs at 50% effort and progress to 75% and 100% effort. Because athletes often find it difficult to gauge their own effort, it is important to emphasize the importance of strictly adhering to the program. Fleisig and colleagues<sup>13</sup> studied healthy pitchers’ ability to estimate their throwing effort. When targeting 50% effort, athletes generated ball speeds of 85% with forces and torque approaching 75% of maximum. A radar gun may be valuable in guiding effort control.

As the player advances through Phase 2, he will increase the volume of pitches as well as the effort in a gradual manner. The player may introduce breaking ball pitches once he demonstrates the ability to throw light batting practice. Phase 2 concludes with the pitcher throwing simulated games, progressing by 15 throws per workout.

## **Hitting**

### **Biomechanics Overview**

The mechanics of hitting a baseball can be broken down into 6 phases: the preparatory phase, stance phase, stride phase, drive phase, bat acceleration phase, and follow-through phase.<sup>14</sup> While progressing through a return-to-play protocol, it is important to understand and teach the player proper swing mechanics during each phase in order to minimize the risk of re-injury (**Figure 2**).

The preparatory phase occurs as the player positions himself into the batter’s box. This phase is highly individualized, depending on each player’s personal preference. Though significant variability in approach exists, there are 3 basic stances a player can take in preparation to bat. In the closed stance, the batter’s front foot is positioned closer to the plate than the back foot. A more popular stance is the open stance, where the player’s back foot is placed closer to the plate than the front foot. The square batting stance is the most common stance. This stance is where both feet are in line with the pitcher and parallel with the edge of the batter’s box. Most authors agree that the

square stance is the optimal position because it provides batters the best opportunity to hit pitches anywhere in the strike zone and limits compensatory or extra motion to their swing.<sup>15</sup>

Once the player begins the swing, he has entered the loading period, which is divided into the stance, stride, and drive phases. The loading period, also known as coiling or triggering, begins as the athlete eccentrically stretches agonist muscles and rotates the body away from the incoming ball. The elastic energy stored during this stretching is released during the concentric contraction of the same muscles and transferred through the entire kinetic chain as different segments of the body are rotated; it culminates in effort directed at hitting the baseball.<sup>16</sup>

In each phase of the loading period, certain critical motions should be monitored and corrected in order to return the player to his previous level of competition. Stride length has been shown to be critical in the timing of a batter's swing. A short stride length can cause early initiation of the swing, while a longer stride can produce delayed activation of hip rotation. As the player enters the drive phase, he should have increased elbow flexion in the back elbow compared to the front elbow. The bat should be placed at a position approximately 45° in the frontal plane, and the bat should bisect the batter's helmet. The back elbow should be down, both upper extremities should be positioned close to the hitter's body, and the proximal interphalangeal joints of the hands should align on the handle of the bat. Athletic trainers and coaches should be aware that subtle compensations due to deficits during these movements could cause injury during the swing

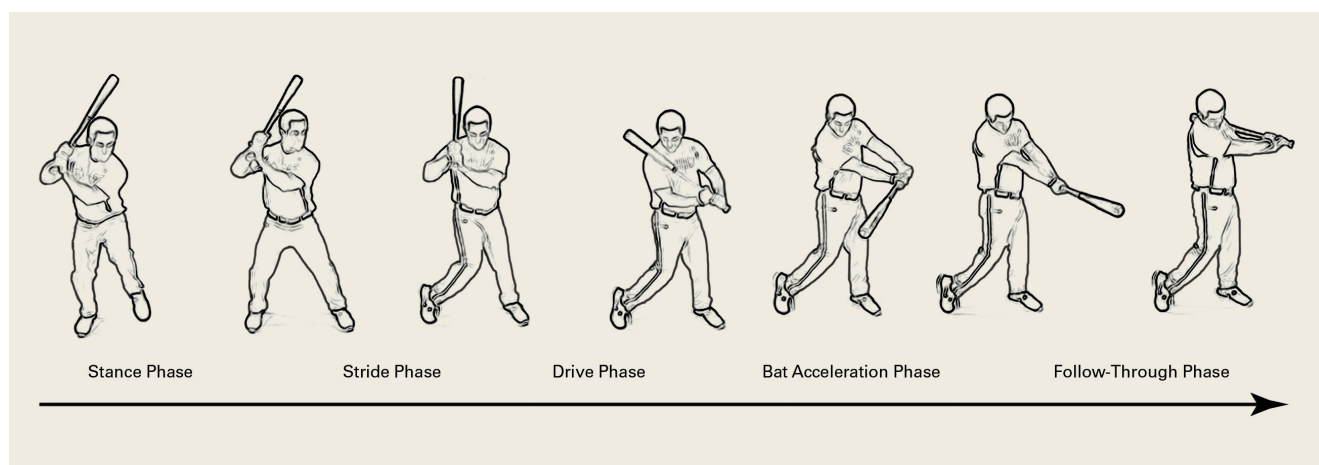
by disrupting the body's natural motion.

The bat acceleration phase occurs from maximal bat loading through striking the ball. In this time, the linear force that has been exerted by the player must be transferred into rotational force through the trunk and upper extremities. When the lead leg contacts the ground, the player has created a closed kinetic chain, where the elastic energy gathered during the loading period is used to produce segmental rotation beginning in the hips and rising through the trunk and out to the arms and hands, finally producing contact with the baseball.<sup>16</sup> To produce effective bat velocity, each segment must rotate in a sequential manner. If the upper extremities reach peak velocity before any lower segment, then the player has lost the ability to efficiently transfer kinetic energy up the kinetic chain.

Finally, the follow-through phase occurs after contact with the baseball and ends with complete deceleration, completing the swing. In order to achieve optimal effort, full hip rotation is needed, which is aided by rotation of the trail foot. Both hips and back laces should face the pitcher upon completion of the swing producing maximum power output.<sup>15</sup>

## Return to Hitting: Principles

As with the initiation of the ITP, an interval hitting protocol (IHP) is designed to begin only after the player has been assessed on impairment measures, physical performance measures, and self-assessment.<sup>17</sup> The player should have minimum to no pain, have no tenderness to palpation, and show adequate range of motion and strength to meet the demands of performing a full hitting



**Figure 2.** Phases of hitting.  
Modified from *Int J Sports Phys Ther*.<sup>15</sup>

cycle.<sup>12</sup> It is recommended that before beginning a return-to-play protocol, the involved extremity should be at least 80% as strong as the uninjured extremity.<sup>18</sup> Physical measures challenging an athlete's ability to perform tasks specific to hitting a baseball must also be considered through standardized examinations of the involved area.<sup>19</sup> Finally, the athlete's self-perception of functional abilities must be taken into account. This gives a subjective account of what the hitter perceives they are able to perform, providing useful insight into whether they are mentally prepared to participate in the protocol.

Like the ITP, progression through the IHP is also based on the player's level of pain and soreness rather than following a specific timetable (**Table**). The program features a 1 day on, 1 day off schedule during which the player completes 1 step per day. The athlete must remain pain-free to progress to the next step and monitor his level of soreness during their workout. If pain or soreness persists, the player should rest for 2 days and be reevaluated upon return.<sup>17</sup>

The same principles of proper warm-up and mechanics apply in the IHP. An athlete should jog or cycle for a minimum of 10 minutes and perform stretching exercises focused on both upper and lower extremity muscles, as batting involves whole body movement. As the athlete progresses through the IHP, having a hitting coach to analyze, correct and maintain proper swing mechanics is valuable in enhancing performance as well as decreasing risk of re-injury.

#### The Interval Hitting Program

For a PDF patient handout that summarizes the phases of this program, see **Appendix 2** online at [www.amjorthopedics.com](http://www.amjorthopedics.com).

**Phase 1 (Dry Swings).** Only the most basic

fundamentals are stressed during this phase. The player should focus on properly moving from one phase of the swing to the next, without the goal of hitting the baseball. Trainers should measure critical points in the swing and correct deficits early.

**Phase 2 (Batting Off a Tee).** In this phase, the player is reintroduced to batting at low intensity with a fixed position target. The initial steps have the batter swing in a position of greatest comfort and natural movement, while the final steps in this phase test the athlete's range of motion and confidence in the previous, healed injury.

**Phase 3 (Soft Toss).** As the player progresses to this phase, a baseball with trajectory is used to simulate differences in placement of pitches used during a game. As the hitter is able to pick up differences in target position, his performance and confidence should both increase.<sup>20</sup> The coach should sit about 30 feet away, facing the hitter at an angle of 45°, and toss the ball in an underhand motion.

**Phase 4 (Simulated Hitting).** In this phase, the player and coach should focus on the timing of sequential body movements in order to elicit proper loading and force production. With the randomized pitch delivery and increased velocity, the hitter will practice against pitches similar to those delivered in competition.

#### Conclusion

Interval throwing and hitting programs are designed to allow the athlete to return to competition through a gradual, stepwise program. This permits the player to prepare his body for the unique stresses associated with throwing and hitting. The medical personnel should familiarize themselves with the philosophy of the interval throwing and hitting programs and individualize them to each athlete. Emphasis on proper warm-up, mechanics,

Table. **Pain and Soreness Rules for an Interval Hitting Program**

Presence of soreness	Recommendation
If there is no soreness present	Progress to next step on next day of training
If soreness occurs during warm-up but dissipates in first 15 swings	Repeat previous step that day of training
If soreness occurs during warm-up but does not dissipate in first 15 swings	Stop, take 2 days off and upon returning repeat last step
If soreness continues more than an hour after session was stopped	Take 1 additional day off and repeat last step
If any pain is felt at any time during workout	Take 2-3 days off and report to trainer for reevaluation. Drop 1-2 steps upon return to interval hitting program

Adapted from *Am J Sports Med*.<sup>17</sup>



and effort control is paramount in expediting return to play while preventing re-injury.

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## Interval Throwing Program

### Phase 1 – General Return to Throwing (Pitchers and Position Players)

Step 1	Step 2	Step 3	Step 4
Flat ground, 45 ft	Flat ground, 45 ft	Flat ground, 60 ft	Flat ground, 60 ft
Arc, crow hop	Arc, crow hop	Arc, crow hop	Arc, crow hop
Warm-up throws 25 throws	Warm-up throws 25 throws	Warm-up throws 25 throws	Warm-up throws 25 throws
REST	REST	REST	REST
Warm-up throws 25 throws	Warm-up throws 25 throws	Warm-up throws 25 throws	Warm-up throws 25 throws
	REST		REST
	Warm-up throws 25 throws		Warm-up throws 25 throws

\*Phase 1 warm-up throws = 20 throws at 30 ft. In Phase 1 throws should be on an arc with a crow hop.

### Phase 1 – General Return to Throwing (Pitchers and Position Players)

Step 5	Step 6	Step 7	Step 8
Flat ground, 90 ft	Flat ground, 90 ft	Flat ground, 120 ft	Flat ground, 120 ft
Arc, crow hop	Arc, crow hop	Arc, crow hop	Arc, crow hop
Warm-up throws 25 throws	Warm-up throws 25 throws	Warm-up throws 25 throws	Warm-up throws 25 throws
REST	REST	REST	REST
Warm-up throws 25 throws	Warm-up throws 25 throws	Warm-up throws 25 throws	Warm-up throws 25 throws
	REST		REST
	Warm-up throws 25 throws		Warm-up throws 25 throws

### Phase 1 – General Return to Throwing (Pitchers and Position Players)

Step 9	Step 10	Step 11	Step 12	Step 13*
Flat ground, 150 ft	Flat ground, 150 ft	Flat ground, 180 ft	Flat ground, 180 ft	Flat ground, 180 ft
Arc, crow hop	Arc, crow hop	Arc, crow hop	Arc, crow hop	Arc, crow hop
Warm-up throws 25 throws	Warm-up throws 25 throws	Warm-up throws 25 throws	Warm-up throws 25 throws	Warm-up throws 25 throws
REST	REST	REST	REST	REST
Warm-up throws 25 throws	Warm-up throws 25 throws	Warm-up throws 25 throws	Warm-up throws 25 throws	Warm-up throws 25 throws
	REST		REST	REST
	Warm-up throws 25 throws		Warm-up throws 25 throws	Warm-up throws 20 throws
				Warm-up throws 15 throws progressing from 120-90 ft

\*Once a position player completes Step 13, he is done with the program and can begin position-specific drills.

Adapted from: Reinold MM, et al. *J Ortho Sports Phys Ther.* 2002;32(6):293-298.

## Interval Throwing Program *continued*

### Phase 2 – Beginning Pitcher Specific Phase

#### Step 1

Flat ground, distance varies  
Arc, crow hop\*  
Warm-up throws  
15 throws, 60 ft  
10 throws, 90 ft  
10 throws, 120 ft  
20 throws, 60 ft with pitching mechanics

#### Step 2

Flat ground, distance varies  
Arc, crow hop\*  
Warm-up throws  
15 throws, 60 ft  
10 throws, 90 ft  
10 throws, 120 ft  
30 throws, 60 ft using pitching mechanics  
10 throws, 90 ft  
20 throws, 60 ft using pitching mechanics

\*Phase 2 warm-up throws = 20 throws at 30 ft. In Phase 2 throws should be on an arc with a crow hop except when pitching mechanics are noted indicating pitches that should be thrown in a straight line without an arc or crow hop.

### Phase 3 – Stage 1: Fastballs Only

#### Step 1

Mound  
50% effort  
Warm-up throws  
15 throws

#### Step 2

Mound  
50% effort  
Warm-up throws  
30 throws

#### Step 3

Mound  
50% effort  
Warm-up throws  
45 throws

#### Step 4

Mound  
50% effort  
Warm-up throws  
60 throws

#### Step 5

Mound  
50% effort  
Warm-up throws  
70 throws

\*Phase 3 warm-up throws = 50 throws from flat ground at 120 ft with arc and crow hop.

### Phase 3 – Stage 1: Fastballs Only

#### Step 6

Mound  
Effort varies  
45 throws, 50% effort  
30 throws, 75% effort

#### Step 7

Mound  
Effort varies  
30 throws, 50% effort  
45 throws, 75% effort

#### Step 8

Mound  
50% effort  
10 throws, 50% effort  
65 throws, 75% effort

### Phase 3 – Stage 2: Fastballs Only

#### Step 9

Mound  
Effort varies  
60 throws, 75% effort  
15 throws, batting practice

#### Step 10

Mound  
Effort varies  
50 throws, 75% effort  
30 throws, batting practice

#### Step 11

Mound  
Effort varies  
45 throws, 75% effort  
45 throws, batting practice

\*Stage 2 batting practice indicates gradual increase to 100% effort throughout session, fastballs only.

### Phase 3 – Stage 3: Simulated Pitching

#### Step 12

Mound  
Effort varies  
30 throws, 75% effort  
15 breaking balls, 50%  
50 throws, batting practice

#### Step 13

Mound  
Effort varies  
30 throws, 75% effort  
30 breaking balls, 75%  
30 throws, batting practice

#### Step 14

Mound  
Effort varies  
30 throws, 75% effort  
75 throws, batting practice

#### Step 15

Mound  
100% Effort  
Simulated game, progress by 15  
throws per session

\*Stage 3 batting practice indicates gradual increase to 100% effort during session with introduction of breaking balls.



## Interval Hitting Program

### Phase 1 – Normal weight bat

#### Step 1

No ball

50% effort

20 dry swings

REST

20 dry swings

#### Step 2

No ball

50% effort

20 dry swings

REST

20 dry swings

REST

20 dry swings

### Phase 2 – Hitting off a Tee

#### Step 1

Tee at waist height

50% effort

10 dry swings

25 swings middle of the plate

#### Step 2

Tee at waist height

50% effort

10 dry swings

15 swings middle of the plate

REST

10 dry swings

15 swings inside half of plate

REST

10 dry swings

15 swings outside half of plate

#### Step 3

Tee at waist height

75% effort

10 dry swings

15 swings middle of the plate

REST

10 dry swings

15 swings inside half of plate

REST

10 dry swings

15 swings outside half of plate

### Phase 2 – Hitting off a Tee

#### Step 4

Tee height and distance from batter varies

75% effort

10 dry swings

20 swings middle of the plate

5 at chest height

10 at waist height

5 just above knee height

REST

10 dry swings

20 swings inside half of plate

5 at chest height

10 at waist height

5 just above knee height

REST

10 dry swings

20 swings outside half of plate

5 at chest height

10 at waist height

5 just above knee height

#### Step 5

Tee height and distance from batter varies

90% effort

10 dry swings

20 swings middle of the plate

5 at chest height

10 at waist height

5 just above knee height

REST

10 dry swings

20 swings inside half of plate

5 at chest height

10 at waist height

5 just above knee height

REST

10 dry swings

20 swings outside half of plate

5 at chest height

10 at waist height

5 just above knee height

## Interval Hitting Program *continued*

### Phase 3 – Soft Toss

Step 1	Step 2	Step 3
Partner 45° from hitter	Partner 45° from hitter	Partner 45° from hitter
50% effort	50% effort	75% effort
Warm-up swings	Warm-up swings	Warm-up swings
25 waist high swings from partner	10 swings waist high, middle of the plate	10 swings waist high, middle of the plate
	REST	REST
	Warm-up swings	Warm-up swings
	10 swings chest high, middle of the plate	10 swings chest high, middle of the plate
	REST	REST
	Warm-up swings	Warm-up swings
	10 swings just above knee, middle of the plate	10 swings just above knee, middle of the plate

### Phase 3 – Soft Toss

Step 4	Step 5
Partner 45° from hitter	Partner 45° from hitter
75% effort	90% effort
Warm-up swings	Warm-up swings
30 swings middle of the plate	30 swings middle of the plate
10 waist high	10 waist high
10 chest high	10 chest high
10 just above knee	10 just above knee
REST	REST
Warm-up swings	Warm-up swings
10 swings inside half of plate	15 swings inside half of plate
10 swings outside half of plate	15 swings outside half of plate

\*Phase 3 warm-up swings = 10 dry swings, 10 tee swings.

### Phase 4 – Simulated Hitting

Step 1	Step 2	Step 3	Step 4
Partner behind “L” screen	Partner behind “L” screen	Partner behind “L” screen	Partner behind “L” screen
50% effort	75% effort	75% effort	90%-100% effort
Warm-up swings	Warm-up swings	Warm-up swings	Warm-up swings
30 swings at fastball	25 swings at fastball with random placement	25 swings at fastball with random placement	25 swings at fastball with random placement
10 middle	REST	REST	REST
10 chest high	Warm-up swings	Warm-up swings	Warm-up swings
10 above knee	15 swings at change-up with random placement	15 swings at change-up with random placement	15 swings at change up with random placement
		REST	REST
		Warm-up swings	Warm-up swings
		15 swings at curveball with random placement	15 swings at curveball with random placement

\*Phase 4 warm-up swings = 10 tee swings, 10 soft toss swings.