ATHLETIC TRAINING PROGRAM

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ABSTRACT

A method of training a baseball pitcher includes instructing the pitcher to perform a group of throws in a kneeling position, instructing the pitcher to repeat the group of throws in a rocker position, and instructing the pitcher to repeat the group of throws in a run-and-gun position. Performing a group of throws includes performing a set of throws for each of a plurality of balls with different weights, wherein performing a set of throws includes throwing a first throw modality and throwing a second throw modality, and wherein the first throw modality includes holding the ball during the throw and the second throwing modality includes releasing the ball throughout the throw.
### FIGURE 1A

<table>
<thead>
<tr>
<th></th>
<th>2lb Ball</th>
<th>1lb Ball</th>
<th>6oz Ball</th>
<th>5oz Ball</th>
<th>4oz Ball</th>
<th>2oz Ball</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kneel</td>
<td>3 hold</td>
<td>2 release</td>
<td>3 hold</td>
<td>2 release</td>
<td>3 hold</td>
<td>2 release</td>
</tr>
<tr>
<td>Rocker</td>
<td>3 hold</td>
<td>2 release</td>
<td>3 hold</td>
<td>2 release</td>
<td>3 hold</td>
<td>2 release</td>
</tr>
<tr>
<td>Run and Gun</td>
<td>3 hold</td>
<td>2 release</td>
<td>3 hold</td>
<td>2 release</td>
<td>3 hold</td>
<td>2 release</td>
</tr>
</tbody>
</table>

### FIGURE 1B

<table>
<thead>
<tr>
<th></th>
<th>Hold</th>
<th>Release</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Knee</td>
<td>Rocker</td>
</tr>
<tr>
<td>2lb Ball</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1lb Ball</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6oz Ball</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5oz Ball</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4oz Ball</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2oz Ball</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
Perform Group of Exercises in a First Position

Perform Group of Exercises in a Second Position

First Modality and Second Modality for First Object

First Modality and Second Modality for Second Object

First Modality and Second Modality for Third Object

First Modality and Second Modality for First Object

First Modality and Second Modality for Second Object

First Modality and Second Modality for Third Object

FIGURE 2
<table>
<thead>
<tr>
<th></th>
<th>Hold</th>
<th>Release</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Knee</td>
<td>Rocker</td>
</tr>
<tr>
<td>2lb Ball</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1lb Ball</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6oz Ball</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5oz Ball</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4oz Ball</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2oz Ball</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

**FIGURE 3**
Measuring Velocity for a Number of Weighted Balls

Determining Velocity Differentials for Weighted Ball Pairs

Adapting a Training Program Based on the Differentials

FIGURE 4
Benchmark Velocity of 5oz Regulation Baseball

Receiving Velocities of a Number of Weighted Balls

Determining Velocity Differentials for Weighted Ball Pairs

Accessing a Database of Predetermined Criteria

Comparing the Differentials with Associated Criteria

Adapting a Training Program Based on the Comparison

FIGURE 5
ATHLETIC TRAINING PROGRAM
CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 61/752,378, filed Jan. 14, 2013, the disclosure of which is incorporated by reference herein in its entirety.

BACKGROUND

[0002] Injuries are prevalent in every sport. Injuries can strike every athlete, but for professional athletes, the pressure to enhance performances brings an increased risk of injury.

[0003] In one example, the need for faster baseball pitches has led to more shoulder injuries. Unfortunately, such injuries might be expected due to the large financial gains from small performance enhancements—the difference in a major league and a minor league salary is at least $300,000, but the difference between playing in the big leagues may be just 1 mph extra on a fastball.

[0004] The cost to Major League Baseball™ is tremendous—in 2010, pitcher shoulder injuries accounted for 4,747 days on the “disabled list.” With the average Major League™ salary being $3,340,133, shoulder injuries accounted for a loss of more than $97,000,000. Thus, there is a need to prevent such injuries before they happen.

[0005] Further, a severe injury can have devastating consequences on performance because current treatment methods are largely ineffectual. For example, only 35-50% of pitchers return to their previous level of performance following a shoulder injury. Thus, the prior art approaches leave substantial room for improvement in both prevention and rehabilitation.

BRIEF SUMMARY

[0006] The presently disclosed embodiments are directed to solving one or more of the problems presented in the prior art, as well as providing additional features that will become readily apparent by reference to the following detailed description when taken in conjunction with the accompanying drawings.

[0007] In a first example, a method of training a baseball pitcher comprises instructing the pitcher to perform a group of throws in a kneeling position, wherein performing a group of throws comprises performing a set of throws for each of a plurality of balls with different weights, wherein performing a set of throws comprises throwing a first throw modality and throwing a second throw modality, and wherein the first throw modality comprises holding the ball throughout the throw and the second throw modality comprising releasing the ball during the throw; instructing the pitcher to repeat the group of throws in a rocker position; and instructing the pitcher to repeat the group of throws in a run-and-gun position.

[0008] In a second example, the method of the first example further comprises measuring the difference in speed for pairs of balls and altering the ratio of first modality and second modality in a set of throws.

[0009] In a third example, the first modality and second modality of the first example are performed in a ratio of three to two.

[0010] In a fourth example, the step of instructing the pitcher to repeat the group of throws in the rocker position of the first example only occurs when the pitcher successfully performs the group of exercises in the kneeling position.

[0011] In a fifth example, the step of instructing the pitcher to repeat the group of throws in the run and gun position of the fourth example only occurs when the pitcher is able to hold each ball at full capacity in the rocker position.

[0012] In a sixth example, a method for adapting a training program for baseball pitching comprises measuring velocities of a plurality of pitches for a respective plurality of balls, wherein each of the plurality of balls has a weight different from the remainder of the plurality; determining a plurality of velocity differentials for a respective plurality of ball pairs; and adapting the training program based on the determined plurality of velocity differentials.

[0013] In a seventh example, the plurality of balls of the sixth example comprises a 2 lb ball, a 1 lb ball, a 6 oz ball, a 5 oz ball, a 4 oz eball, and a 2 oz ball.

[0014] In an eighth example, the plurality of ball pairs of the seventh example comprises the 2 lb and the 1 lb, the 1 lb and the 6 oz, the 6 oz and the 5 oz, the 5 oz and the 4 oz, and the 4 oz and the 2 oz.

[0015] In a ninth example, adapting the training program of the eighth example further comprises increasing strength training when at least one of the following velocity differentials is determined to be below an associated threshold: the velocity differential of the 2 lb and the 1 lb is less than 10 miles per hour and the velocity differential of the 1 lb and the 6 oz is less than 15 miles per hour.

[0016] In a tenth example, increasing strength training of the ninth example comprises increasing a percentage of eccentric exercises in a training program comprising concentric and eccentric exercises.

[0017] In an eleventh example, the percentage of eccentric exercises of the tenth example are increased for each ball weight of a ball pair determined to have a velocity differential less than the associated threshold.

[0018] In a twelfth example, adapting the program of the eighth example further comprises increasing speed training when the velocity differential between either of the 6 oz and the 5 oz, and the 5 oz and the 4 oz is outside a range comprising 4 miles per hour.

[0019] In a thirteenth example, increasing speed training in the twelfth example comprises increasing a percentage of concentric exercises in a training program comprising concentric and eccentric exercises.

[0020] In a fourteenth example, the percentage of concentric exercises in the thirteenth example are increased for each of the ball weights from a ball pair where the velocity differential is determined to be outside the range comprising 4 miles per hour.

[0021] In a fifteenth example, a velocity in the twelfth example is outside a range comprising 4 miles per hour when the velocity differential is below 3.5 miles per hour or above 4.5 miles per hour.

[0022] In a sixteenth example, adapting the program in the eighth example further comprises increasing speed training when the velocity differential between the 2 oz and the 4 oz is outside a range comprising 8 miles per hour.

[0023] In a seventeenth example, increasing speed training in the sixteenth example comprises increasing a percentage of concentric exercises in a training program comprising concentric and eccentric exercises.

[0024] In an eighteenth example, the percentage of concentric exercises in the seventeenth example are increased for
each of the 4 oz and 2 oz ball where the velocity differential is determined to be outside the range comprising 8 miles per hour.

In a nineteenth example, a velocity in the sixteenth example is outside a range comprising 8 miles per hour when the velocity differential is below 7.5 miles per hour or above 8.5 miles per hour.

In a twentieth example, a method of training includes performing a group of exercises in a first position, wherein performing a group of exercises comprises performing a set of exercises for each of a first object, a second object, and a third object, wherein the first, second, and third objects have different weights, and wherein performing a set of exercises comprises performing a motion with an object in a first modality and performing the motion with the object in a second modality; and repeating the group of exercises in a second position different from the first.

In a twenty-first example, the first and second positions of the twentieth example produce different ground-force translations when performing the motion.

In a twenty-second example, each of the first and second positions in the twenty-first example produce a ground-force translation of one of an athlete’s body weight, two times the athlete’s body weight, and four times the athlete’s body weight.

In a twenty-third example, the method of the twentieth example further comprises repeating the group of exercises in a third position different from the first and second, wherein the first, second, and third positions produce different ground force translations when performing the motion.

In a twenty-fourth example, each of the first, second, and third positions of the twenty-third example produce a ground-force translation of one of an athlete’s body weight, two times the athlete’s body weight, and four times the athlete’s body weight.

In a twenty-fifth example, the first and second positions of the twentieth example are selected from a group consisting of a kneeling position, a rocker position, and a run-and-gun position.

In a twenty-sixth example, the method of the twentieth example further comprises repeating the group of exercises in a third position different from the first and second, wherein the first, second, and third positions are selected from a group consisting of a kneeling position, a rocker position, and a run-and-gun position.

In a twenty-seventh example, the first modality of the twentieth example comprises a concentric motion and the second modality comprises an eccentric motion.

In a twenty-eighth example, the first modality of the twentieth example is performed three times and the second modality is performed two times.

In a twenty-ninth example, the objects of the twentieth example are balls and the motion is a passing motion.

In a thirtieth example, the first modality of the twenty-ninth example is a throwing motion where the ball is held throughout the motion and the second modality is a throwing motion where the ball is released during the motion.

In a thirty-first example, the step of repeating the group of exercises in a second position in the twentieth example different from the first is only performed when a user successfully performs the group of exercises in the first position.

In a thirty-second example, the objects of the thirty-first example are baseballs, wherein the motion is a throwing motion, wherein the first modality is a throwing motion where a baseball is held throughout the motion and the second modality is a throwing motion where a baseball is released during the motion, and wherein the user successfully performs the group of exercises in the first position when the user is able to hold each baseball during the throwing motion performed at full capacity in the first position.

In a thirty-third example, the first object, second object, and third object of the twentieth example are respectively a first elongated object, a second elongated object, and a third elongated object.

In a thirty-fourth example, the first, second, and third elongated objects of the thirty-third example are baseball bats.

In a thirty-fifth example, the first, second, and third elongated objects of the thirty-third example are golf clubs.

In a thirty-sixth example, the set of exercises of the thirty-third example is repeated in the second position only when a user successfully performs the set of exercises in the first position for each of the first elongated object, second elongated, and third elongated object.

In a thirty-seventh example, a set of exercises in the third-sixth example is performed successfully when a speed of the elongated object during the concentric motion approximates a speed of the elongated object in the eccentric motion.

In a thirty-eighth example, the speed of the elongated object in the thirty-seventh example is determined using a motion detector.

In a thirty-ninth example, the speed of the elongated object of the thirty-seventh example is determined by a user based on audible feedback.

In a fortieh example, the set of exercises in the thirty-third example is repeated in a third position for each of the first elongated object, second elongated, and third elongated object.

In a forty-first example, the set of exercises in the forty-first example is repeated in the third position only when a user successfully performs the set of exercises in the second position for each of the first elongated object, second elongated, and third elongated object.

In a forty-second example a set of exercises in the forty-first example is performed successfully when a speed of the elongated object during the concentric motion approximates a speed of the elongated object in the eccentric motion.

In a forty-third example, the speed of the elongated object in the forty-second example is determined using a motion detector.

In a forty-fourth example, the speed of the elongated object in the forty-second example is determined by a user based on audible feedback.

In a forty-fifth example, the concentric and eccentric motions of the thirty-third example are repeated for a total of five times each.

In a forty-sixth example, the concentric and eccentric motions of the thirty-third example are repeated for a total of two times each.

In a forty-seventh example, the concentric motion of the twenty-eighth example is a typical motion of the sport and the eccentric motion is a reverse motion of the typical motion.

In a forty-eighth example, a computer readable medium contains executable instructions that when executed perform a method of recommending an adaptation of a training program for baseball pitching, the method comprising: receiving velocities of a plurality of pitches for a respective
plurality of balls, wherein each of the plurality of balls has a weight different from the remainder of the plurality; determining a plurality of velocity differentials for a respective plurality of ball pairs; accessing a database comprising predetermined criteria; comparing the determined velocity differentials to associated criteria from the database; and recommending an adaptation of the training program based on the comparison.

In a forty-ninth example, the plurality of balls in the forty-eighth example comprises a 2 lb, a 1 lb, a 6 oz, a 5 oz, a 4 oz, and a 2 oz. In a fiftieth example, the plurality of ball pairs in the forty-ninth example comprises the 2 lb and the 1 lb, the 1 lb and the 6 oz, the 6 oz and the 5 oz, the 5 oz and the 4 oz, and the 4 oz and the 2 oz.

In a fifty-first example, adapting the training program of the fiftieth example further comprises increasing strength training when at least one of the following velocity differentials is determined to be below an associated threshold: the velocity differential of the 2 lb and the 1 lb is less than 10 miles per hour and the velocity differential of the 1 lb and the 6 oz is less than 15 miles per hour.

In a fifty-second example, increasing strength training in the fifty-first example comprises increasing a percentage of eccentric exercises in a training program comprising concentric and eccentric exercises.

In a fifty-third example, the percentage of eccentric exercises of the fifty-second are increased for each ball weight of a ball pair determined to have a velocity differential less than the associated threshold.

In a fifty-fourth example, adapting the program of the fiftieth example further comprises increasing speed training when the velocity differential between either of the 6 oz and the 5 oz, and the 5 oz and the 4 oz is outside a range comprising 4 miles per hour.

In a fifty-fifth example, increasing speed training in the fifty-fourth example comprises increasing a percentage of concentric exercises in a training program comprising concentric and eccentric exercises.

In a fifty-sixth example, the percentage of concentric exercises in the fifty-fifth example is increased for each of the ball weights from a ball pair where the velocity differential is determined to be outside the range comprising 4 miles per hour.

In a fifty-seventh example, a velocity in the fifty-fourth example is outside a range comprising 4 miles per hour when the velocity differential is below 3.5 miles per hour or above 4.5 miles per hour.

In a fifty-eighth example, adapting the program of the fiftieth example further comprises increasing speed training when the velocity differential between the 2 oz and the 4 oz is outside a range comprising 8 miles per hour.

In a fifty-ninth example, increasing speed training in the fifty-eighth example comprises increasing a percentage of concentric exercises in a training program comprising concentric and eccentric exercises.

In a sixtieth example, the percentage of concentric exercises in the fifty-ninth example is increased for each of the 2 oz and 4 oz ball where the velocity differential is determined to be outside the range comprising 8 miles per hour.

In a sixtieth example, a velocity of the fifty-eighth example is outside a range comprising 8 miles per hour when the velocity differential is below 7.5 and above 8.5 miles per hour.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1A provides a table showing the positions, weights, and modalities for a baseball example.

FIG. 1B provides another table showing the positions, weights, and modalities of FIG. 1A.

FIG. 2 provides a flowchart for an exemplary method of training in accordance with one example.

FIG. 3 provides table 300 showing possible adaptations to the training program of FIG. 1B.

FIG. 4 provides a flowchart of a method for adapting a training program for baseball pitching.

FIG. 5 provides a flowchart for a computer implemented method of adapting a training program for baseball pitching.

DETAILED DESCRIPTION

The present disclosure recognizes that athletes in some sports are more prone to injury than others, even when the sports use similar biomechanics. For example, there are many similarities between a tennis serve and a fastball pitch. Both require a rotation of the shoulder joint. Both require the arm to move above the shoulder joint. Both are performed at full capacity and require a specific sequencing of hips, shoulders, and arms. There are also differences. Notably, tennis players retain control of the racket throughout the motion, where a pitcher releases the ball at the end of the pitch. Another important difference is that tennis players are far less prone to shoulder injuries.

Why the difference in propensity for shoulder injury? Both tennis players and baseball players activate “accelerator” muscles in their shoulder to begin the motion and speed up the arm. However, the tennis player must activate and balance “decelerator” muscles at the end of the swing in order to maintain control of the retained tennis racket. By contrast, the baseball player’s decelerators are not similarly activated because the baseball player releases the ball. Thus, the baseball player develops the “accelerators” in the shoulder by throwing, but does little to balance “decelerators” in the shoulder.

Over time, the imbalance in the shoulder can lead to a condition termed Glenhumoral Internal Rotation Deficit (“GIRD”). GIRD measures the difference in shoulder rotation (full external rotation to full internal rotation) between a throwing arm and a non-throwing arm. A 20 degree difference is an accepted indicator of shoulder pathology, future injury, and reduced performance. GIRD may be a direct result of the imbalance in accelerator (external shoulder rotation) and decelerator (internal shoulder rotation) exercises.

The imbalance in accelerator and decelerator training may also explain why Major League™ pitchers can throw a regular 5 oz baseball, but sometimes struggle to throw a 2 oz wiffle ball painlessly. By contrast, a little leaguer may effortlessly throw a wiffle ball, but may struggle to throw a 5 oz baseball using a normal throwing motion. The explanation may be that the little leaguer does not have the accelerator strength to throw a regular baseball, whereas the Major League™ pitcher does not have the decelerator strength to control the speed of his arm after releasing the wiffle ball and, hence, may experience excess stress or pain on the follow through.

The exemplary training and evaluation programs described here provide both strength and speed training, reducing the risk of injury while enhancing performance.
Some of the programs described here can be termed “personally adaptive” in that they are configured to adjust for an athlete’s personal arm action as well as strength and flexibility progress and so create a specific training program for athlete’s joint thresholds. Although primarily described with relation to baseball pitching, it should be understood that the methods and programs described herein can be applied to any sport and particularly those requiring a joint movement.

In some embodiments, a training program exercises an athlete’s accelerometer and decelerator joint muscles. This may beneficially reduce the athlete’s propensity for injury in the joint. This may also increase the athlete’s performance. It has been discovered, through extensive experimentation and trials with professional athletes, that a beneficial by-product of the training programs described here is an increase in joint rotational speed and ball velocities.

In addition or separate from the training program above, an evaluation program may determine which, if any, of an athlete’s accelerometer and decelerator muscles require more attention during training. In this way, a training program may be adapted to the personal requirements of the athlete. This may serve to complement a training program by increasing the athlete’s safety and performance.

An exemplary training program will be discussed first, and an evaluation and adaption program described later. The training program may include performing a set of exercises in a first modality and a second modality using objects of different weights. The first modality primarily exercises decelerator muscles and the second modality primarily exercises accelerometer muscles.

In baseball pitching, for example, the first modality may be the throwing motion of a regular pitch with the ball retained throughout the motion, and the second modality may be a regular pitch with the ball released as normal. For this example, the first modality may primarily exercise the decelerator muscles in the pitching shoulder and the second modality may primarily exercise the accelerometer muscles in the pitching shoulder.

The first modality and second modality may be performed in different ratios to account for different distributions of accelerometer and decelerator muscles in the joint. In a shoulder, for example, there are approximately three accelerators and two decelerators. Thus, a training program for a baseball pitcher may include pitching three times in the first modality (decelerator exercise: throwing motion holding the ball) to every two times in the second modality (accelerator exercise: throwing motion with release of the ball). The ratio may be varied in accordance with an evaluation program, as described further below.

Objects of different weights may be used to train further the accelerators and decelerators. Varying the weights varies the emphasis on accelerators and decelerators. The athlete’s performance with the varying weight may provide a useful tool for evaluating the athlete’s accelerometer-decelerator balance.

In some variations, one object is similar, or the same as, an object typically used in a sport of interest. For example, a training program for baseball pitchers may incorporate more than the regulation 5 oz baseball into the training program. In swinging and striking variations, at least two further objects are added—at least one with a weight greater than the typical object and at least one with a weight less than the typical object. In a baseball pitching example, the training program may incorporate a 2 oz, a 4 oz, a 5 oz, a 6 oz, a 1 lb, and a 2 lb ball. In a baseball bat swing example, the training may incorporate a 28 oz, a 34 oz, or a 40 oz bat.

Each of the first and second modalities may be performed using each object. If the modalities are performed in a ratio, then the ratio may be repeated for each object. In some variations, different ratios are performed for different objects. A different ratio may result from an evaluation of an athlete’s performance, as described more fully below with respect to an exemplary evaluation program.

The training program may also vary the positions at which the set of exercises is performed. Each position may produce a different ground force translation when performing the exercise. As used herein, ground force translation can be understood to be the force imparted on a person by their interaction with the ground. The translated force may be in a direction that is not perpendicular to the surface of ground. As used herein, a position at which the set of exercises is performed may include a movement, as described herein further below. That is, a position need not be stationary but, in some instances, requires movement.

For example, when a pitcher throws from a kneeling position, the ground force translation in the direction of the throw approximates the pitcher’s body weight. When the pitcher throws from a “rocker” position, the ground force translation in the direction of the throw approximates the pitcher’s body weight. When the pitcher throws from a “run-and-gun” position, the ground force translation in the direction of the throw approximates four times the pitcher’s body weight.

As used herein, a “kneeling” position can be understood to include both knees contacting the ground throughout the motion. As used herein, a “rocker” position can be understood to include a walking or one-step motion. As used herein, a “run-and-gun” position can be understood to include a running motion that terminates during the throwing motion (that is, the front foot is planted before the throw at the end of the run).

By varying the ground-force translation, the force exerted on the athlete during the exercise is also varied. This varies the additional forces exerted on the accelerators and decelerators during the motion. In the baseball example, increasing the ground force translation may increase the difficulty of holding the ball throughout the motion.

In some variations, the training program may include a requirement that an athlete does not progress to a position of higher ground force translation until the athlete has successfully completed all the modalities and weights in the first position. This may ensure the athlete has sufficiently trained the balance of his or her accelerators and decelerators before increasing the strain on the joint by progressing to a position with a higher ground force translation.

In one pitching example, the pitcher may be required to perform successfully all throw modalities (holding the ball and releasing the ball) for all weights in the kneeling position before progressing to the rocker position. One measure of success may be the ability to hold each weighted ball at maximum arm speed for all throws.

Fig. 1A provides a table 100 showing the positions, weights, and modalities for a baseball example. The first column 102 provides three positions: kneeling, rocker, and run-and-gun. The first row 104 provides the weights: 2 lb, 1 lb, 6 oz, 5 oz, 4 oz, and 2 oz. The first modality 106 (throw with ball held) and second modality 108 (throw with ball released) are performed in the ratio of 3:2.
FIG. 1B provides a table showing the positions, weights, and modalities of FIG. 1A, but segregated by whether a ball is held or released. The first column provides the ball weights. The first two rows provide the three positions, separated by the first modality (hold) and second modality (release).

FIG. 2 provides a flowchart for an exemplary method of training in accordance with one example. Method 200 may be a more generalized variation of the baseball pitching training method described above and can be used in any sport. The method includes performing a group of exercises in a first position and performing a group of exercises in a second position different from the first position. Each group of exercises includes performing a set of exercises in a first and second modality for a first object, performing a set of exercises in the first and second modality for a second object, and performing a set of exercises in the first and second modality for a third object. The first, second, and third objects have different weights.

The first and second positions provide different ground force translations. In the baseball example described above, the ground force translation was one of one times body weight, two times body weight, and four times body weight. Other ground-force translation could be used. Also, the baseball example correlated the 1, 2, and 4 ground force transitions to kneeling, rocker, run-and-gun positions, respectively, but other positions could have been used and the classifications could be different in some instances.

Method 200 may also include a third position different from the first two. The third position may provide a further different ground force production.

Each modality may focus on exercising one of an accelerometer muscle group and a decelerator muscle group. In some variations, the modalities may be one of a concentric motion and an eccentric motion. In the pitching example, the modalities described were a throwing motion with release of the ball and a throwing without release of the ball. Other motions could be used. For example, a baseball swing or a golf swing training program may include swinging in a direction for normal activity in the sport (accelerators) and then reversing that swing (decelerators). As used herein, a reverse swing may be understood to be swinging the clubbat from the end position of a normal swing to the beginning position of a normal swing. Other objects could be used for the swinging motion, including elongated objects and non-elongated objects, as the associated sport dictates.

In some examples, the variations are performed in a ratio. In the baseball example given above, the eccentric and concentric motions were performed three times and two times, respectively. However, the number of motions performed may be a multiple of the ratios, for example, six times and four times, nine times and six times, etc. The ratio may vary between weights. For example, an evaluation of an athlete’s performance may indicate benefits from focusing on one of the accelerometer or decelerator muscle groups during training and the ratio may be adjusted accordingly. The ratio may be one to one. For example, swinging motions may use a one-to-one ratio. The actual number of swings may be two swings, five swings, or any number of swings. Two swings and five swings are offered here merely because experimental data shows these are beneficial for warming up before a competitive activity and for training during non-competitive activity, respectively. However, any number of swings at maximum intensity, to tolerance, could be used in the training program.

Method 200 may include more than three objects of different weights. In the baseball example given above, weights of 2 lb, 1 lb, 6 oz, 5 oz, 4 oz, and 2 oz were used. However, other sets of balls could be used including a subset of the foregoing, all of the foregoing with others, a subset of the foregoing with others, or all others. A 5 oz may be included in some examples as a mean weight because it is the regulation weight used in a competitive baseball game. In other training programs, similar approaches may be taken. For example, a mean weight may be a regular baseball bat, with at least one lighter bat (a fungo) and at least one heavier bat (an on-deck bat) included. In the same way, three golf clubs could be used. For example, a driver shaft for light, a five iron for medium, and a sand wedge for heavy.

Progression from the first position to the second position may require the trainee to complete successfully the exercises at the first position. In some variations, progression may require the trainee to complete the exercises successfully at maximum intensity. As described above, one measure of success in a baseball pitching training program may be the ability to retain the ball throughout all of the throws where the ball is held. In a swinging motion, a measure of success may be the swing in both directions at approximately the same speed. The speed may be determined by a motion detector (such as a radar gun or a bat/club speed monitor) or by auditory feedback. For example, a golf club could be swung back and forward by the athlete, where the athlete listens for the sound of the clubs shaking (the “whoosh”) during both motions. If the sounds match, then the athlete determines that the speed matches for the concentric and eccentric modalities. If the sounds don’t match, the athlete may determine that one of a speed or a strength issue is present and may adjust the training program to rebalance.

In some examples, all exercises are performed at full capacity. This may beneficially serve to fully exercise the accelerometer and decelerator muscles and verify the trainee’s ability to progress to a position of higher ground force translation.

Although the programs above were primarily described with respect to baseball and golf, the training methods described herein could be used in any rotational sport, including, but not limited to, softball, cricket, basketball, American football, javelin, shot put, discus, soccer, water polo, Olympic handball, tennis, badminton, lacrosse, volleyball, bowling, field hockey, and ice hockey.

In one example, a training program for an American football team uses balls of different weights in different positions. The balls used may be the same as the balls described above with respect to baseball. The positions may also be the same. In some variations, the positions are different and can include a kneeling, a step and throw, and a shuffle and throw. In the step and throw, the trainee takes two steps back, plants his rear foot, and throws. In the shuffle and throw, the trainee takes four steps back, runs forward, plants a forward foot, and then throws. The throwing motion for the American football motion may be a throwing motion similar to that of a forward pass in American football. However, the ball need not be an American football and could instead be a smaller, round ball, similar to a baseball.

An exemplary evaluation and adaption program for baseball pitching will now be discussed. The program com-
prises determining a velocity differential of a plurality of ball pairs and adapting a training program based on the velocity differentials.

[0106] For example, a ball pair may include a 6 oz ball and a 5 oz ball. Each ball is thrown in a run and gun by the trainee and the velocity of each ball is measured. The difference between the velocities is determined to calculate a velocity differential for this pair of balls. Based on whether a velocity differential meets a predetermined criteria, the baseball pitching training program is varied.

[0107] In one example, the set includes a 2 lb, a 1 lb, a 6 oz, a 5 oz, 4 oz, and a 2 oz ball. The pairs may include (1) the 2 lb and the 1 lb, (2) the 1 lb and the 6 oz, (3) the 6 oz and the 5 oz, (4) the 5 oz and the 4 oz, and (5) the 4 oz and the 2 oz. In this example, the criteria might be the velocity differential is greater than 10 mph for (1), greater than 15 mph for (2), approximating 4 mph for (3) and (4), and approximating 8 mph for (5). As used herein, a velocity differential can be understood to approximate a target if the velocity differential is within a predetermined range or spread of the target. The range may be +/-1 mph of the target velocity differential, +/-0.5 mph of the target velocity differential, or any range.

[0108] A training program may be adapted based on whether a velocity pair meets the criteria. Continuing with the example above, if pairs (3), (4), or (5) do not approximate the associated mph, then it is determined that the trainee has a speed issue. In that scenario, a ratio of concentric to eccentric exercises in a training program is increased, and the number of throws with release for light balls may be increased and there may be less holds. In some variations, the program is only varied for each of the ball weights in the ball pair that did not meet its criteria. Using the ball example again, if the velocity differential between the 5 oz and 4 oz balls does not approximate 4 mph, then the proportion of concentric to eccentric exercises is increased for both the 5 oz and 4 oz ball, that is, more throws with release for the 5 oz and 4 oz balls and less holds.

[0109] If ball pairs (1) or (2) do not exceed the associated mph, then it is determined that the trainee has a strength issue. In that scenario, a ratio of eccentric exercises to concentric exercises in a training program is increased, that is, the number of heavy ball throws is increased. In some variations, the program is only varied for each of the ball weights in the ball pair that did not meet its criteria. Using the ball example again, if the velocity differential between the 1 lb and 6 oz balls does not exceed or equal 15 mph, then the proportion of eccentric and concentric exercises is increased. Using the training programs described herein, this would result in increased holds and throws with the heavier balls.

[0110] A velocity differential issue limited to one ball pair may be indicative of a psychological impediment. For example, a previous injury or painful motion with a 5 oz regulation baseball weight may subconsciously limit the pitcher’s ability to fully commit to the action. Changing the ratios with more light balls may beneficially serve to recommit the mind to improve 5 oz pitch speed velocities.

[0111] FIG. 3 provides table 300, which shows possible adaptations to the training program of Table 150, described above with respect to FIG. 1B. Table 300 may result from testing a trainee’s performance, wherein the test indicates speed issues. In this case, the number of each of the 5 oz and 4 oz throw with release are increased, thereby focusing training on speed exercises. Because strength is not an issue, the 21b and 11b throws with release are eliminated from the program.

[0112] Although FIG. 3 illustrates each position having the same number of throws for each weight, the distribution is not so limited. In some embodiments, the distribution may be varied to avoid monotonous overtraining (which can lead to neural stagnation). Such considerations may be factored into the adaption program. Some variations may adapt the program so that a constant number of overall repetitions are performed. In FIG. 3, for example, 2 repetitions were added to each of the 5 oz ball and 4 oz ball throw with release, and a corresponding two repetitions were removed from each of the 2 lb and 1 lb throws with release.

[0113] FIG. 4 provides a flowchart of a method 400 for adapting a training program for baseball pitching. The method includes measuring 402 velocities of pitches for a number of balls of different weights. The method continues with determining 404 velocity differentials for pairs of balls. The method then adapts 406 a training program based on the velocity differentials.

[0114] Exercises in the evaluation and adaptation program may be performed at full capacity. This may beneficially serve to provide a more accurate picture of the trainee’s strengths and weaknesses.

[0115] Although described with reference to baseball pitching and with reference to the training programs described herein, the evaluation and adaption programs can be used with any rotational throwing and striking sport and any training program that employs concentric and eccentric exercises. In a rotational striking sport (with an elongated object, for example), a ball may be placed on a tee and then struck by the trainee with each of the objects during training. Differences in ball speed in such scenarios may indicate that a particular object weight is better suited for the trainee. For example, if a ball exit velocity was considerably higher for a heavy bat, then the trainee may wish to switch to the heavy bat in competition. In some variations, the difference in exit ball velocity is used to adapt a training program, similar to the baseball pitching example given above.

[0116] In one variation, a computer program is configured to determine the adaptations for the training program. FIG. 5 provides a flow chart 500 for an exemplary computer implemented method of recommending an adaptation of a training program for baseball pitching. The method begins by benchmarking 502 the velocity of a 5 oz regulation baseball in a run and gun position. The method continues by receiving 504 velocities for a number of balls of different weights. Then, the computer program determines 506 velocity differentials for a plurality of ball pairs. The computer program accesses 508 a database of predetermined criteria and then compares 510 the velocity differentials to associated criteria. The computer program then recommends 512 an adaptation of the training program based on the comparison. The computer program may be associated with any of the training program methods described herein, but is not so limited.

[0117] In some embodiments, the steps of a method or algorithm described in connection with the embodiments disclosed herein may be embodied directly in hardware, in firmware, in a software module executed by a processor module, or in any practical combination thereof. A software module may reside in computer-readable storage, which may be realized as RAM memory, flash memory, ROM memory, EEPROM memory, EPROM memory, EEPROM memory, registers, a hard disk, a
The computer-readable storage may include a criteria database in accordance with one or more exemplary embodiments of the invention. Criteria databases may be configured to store, maintain, and provide data as needed to support a recommendation for adapting a baseball training program. Moreover, a criteria database may be a local database coupled to processor module, or may be a remote database, for example, a central network database, and the like. A criteria database may be configured to maintain, without limitation, velocity differentials and associated thresholds. In this manner, a criteria database may include a lookup table for purposes of providing a recommended adaptation of a baseball training program.

In this document, the terms “computer program product,” “computer-readable medium,” and the like, may be used generally to refer to media such as, memory storage devices, or storage unit. These, and other forms of computer-readable media, may be involved in storing one or more instructions for use by processor to cause the processor to perform specified operations. Such instructions, generally referred to as “computer program code” (which may be grouped in the form of computer programs or other groupings), when executed, enable the computing system. In this document, computer readable storage may be a transitory or a non-transitory, where non-transitory computer readable storage comprises all computer readable storage with the sole exception of a transitory, propagating signal.

Additionally, memory or other storage, as well as communication components, may be employed in embodiments of the invention. It will be appreciated that, for clarity purposes, the above description has described embodiments of the invention with reference to different functional units and processors. However, it will be apparent that any suitable distribution of functionality between different functional units, processing logic elements or domains may be used without detracting from the invention. For example, functionality illustrated to be performed by separate processing logic elements, or controllers, may be performed by the same processing logic element, or controller. Hence, references to specific functional units are only to be seen as references to suitable means for providing the described functionality, rather than indicative of a strict logical or physical structure or organization.

All publications, including patent documents and scientific articles, referred to in this application and the bibliography and attachments are incorporated by reference in their entirety for all purposes to the same extent as if each individual publication were individually incorporated by reference.

Citation of the above publications or documents is not intended as an admission that any of the foregoing is pertinent prior art, nor does it constitute any admission as to the contents or date of these publications or documents.

Although the present invention has been fully described in connection with embodiments thereof with reference to the accompanying drawings, it is to be noted that various changes and modifications will become apparent to those skilled in the art. Such changes and modifications are to be understood as being included within the scope of the present invention. The various embodiments of the invention should be understood that they have been presented by way of example only, and not by way of limitation. Likewise, the various diagrams may depict an example architectural or other configuration for the invention, which is done to aid in understanding the features and functionality that can be included in the invention. The invention is not restricted to the illustrated example architectures or configurations, but can be implemented using a variety of alternative architectures and configurations. Additionally, although the invention is described above in terms of various exemplary embodiments and implementations, it should be understood that the various features and functionality described in one or more of the individual embodiments are not limited in their applicability to the particular embodiment with which they are described. They instead can be applied, alone or in some combination, to one or more of the other embodiments of the invention, whether or not such embodiments are described, and whether or not such features are presented as being a part of a described embodiment. Thus the breadth and scope of the invention should not be limited by any of the above-described exemplary embodiments.
Additionally, memory or other storage, as well as communication components, may be employed in embodiments of the invention. It will be appreciated that, for clarity purposes, the above description has described embodiments of the invention with reference to different functional units and processors. However, it will be apparent that any suitable distribution of functionality between different functional units, processing logic elements or domains may be used without detracting from the invention. For example, functionality illustrated to be performed by separate processing logic elements, or controllers, may be performed by the same processing logic element, or controller. Hence, references to specific functional units are only to be seen as references to suitable means for providing the described functionality, rather than indicative of a strict logical or physical structure or organization.

Unless defined otherwise, all technical and scientific terms used herein have the same meaning as is commonly understood by one of ordinary skill in the art to which this invention belongs. All patents, applications, published applications and other publications referred to herein are incorporated by reference in their entirety. If a definition set forth in this section is contrary to or otherwise inconsistent with a definition set forth in the patents, applications, published applications and other publications that are herein incorporated by reference, the definition set forth in this section prevails over the definition that is incorporated herein by reference.

1 claim:

1. A method of training a baseball pitcher, the method comprising:

   instructing the pitcher to perform a group of throws in a kneeling position, wherein performing a group of throws comprises performing a set of throws for each of a plurality of balls with different weights, wherein performing a set of throws comprises throwing a first throw modality and throwing a second throw modality, and wherein the first throw modality comprises holding the ball throughout the throw and the second throw modality comprising releasing the ball during the throw; instructing the pitcher to repeat the group of throws in a rocker position; and

   instructing the pitcher to repeat the group of throws in a run-and-gun position.

2. The method of claim 1, further comprising measuring the difference in speed for pairs of balls and altering the ratio of first modality and second modality in a set of throws.

3. The method of claim 1, wherein the first modality and second modality are performed in a ratio of two to three.

4. The method of claim 1, wherein the step of instructing the pitcher to repeat the group of throws in the rocker position only occurs when the pitcher successfully performs the group of exercises in the kneeling position.

5. The method of claim 4, wherein the step of instructing the pitcher to repeat the group of throws in the run and gun position only occurs when the pitcher is able to hold each ball at full capacity in the rocker position.

6. A method for adapting a training program for baseball pitching, the method comprising:

   measuring velocities of a plurality of throws for a respective plurality of balls, wherein each of the plurality of balls has a weight different from the remainder of the plurality;

determining a plurality of velocity differentials for a respective plurality of ball pairs; and

adapting the training program based on the determined plurality of velocity differentials.

7. The method of claim 6, wherein the plurality of baseballs comprises a 2 lb ball, a 1 lb ball, a 3 oz ball, a 5 oz ball, a 7 oz ball, and a 2 oz ball.

8. The method of claim 7, wherein the plurality of baseball pairs comprises the 2 lb and the 1 lb, the 1 lb and the 6 oz, the 6 oz and the 5 oz, the 5 oz and the 4 oz, and the 4 oz and the 2 oz.

9. The method of claim 8, wherein adapting the training program further comprises increasing strength training when at least one of the following velocity differentials is determined to be below an associated threshold: the velocity differential of the 2 lb and the 1 lb is less than 10 miles per hour and the velocity differential of the 1 lb and the 6 oz is less than 15 miles per hour.

10. The method of claim 9, wherein increasing strength training comprises increasing a percentage of eccentric exercises in a training program comprising concentric and eccentric exercises.

11. The method of claim 10, wherein the percentage of eccentric exercises are increased for each ball weight of a ball pair determined to have a velocity differential less than the associated threshold.

12. The method of claim 8, wherein adapting the program further comprises increasing speed training when the velocity differential between either of the 6 oz and the 5 oz, and the 5 oz and the 4 oz is outside a range comprising 4 miles per hour.

13. The method of claim 12, wherein increasing speed training comprises increasing a percentage of concentric exercises in a training program comprising concentric and eccentric exercises.

14. The method of claim 13, wherein the percentage of concentric exercises are increased for each of the ball weights from a ball pair where the velocity differential is determined to be outside the range comprising 4 miles per hour.

15. The method of claim 12, wherein a velocity is outside a range comprising 4 miles per hour when the velocity differential is below 3.5 miles per hour or above 4.5 miles per hour.

16. The method of claim 8, wherein adapting the program further comprises increasing speed training when the velocity differential between the 2 oz and the 4 oz is outside a range comprising 8 miles per hour.

17. The method of claim 16, wherein increasing speed training comprises increasing a percentage of concentric exercises in a training program comprising concentric and eccentric exercises.

18. The method of claim 17, wherein the percentage of concentric exercises are increased for each of the 4 oz and 2 oz ball where the velocity differential is determined to be outside the range comprising 8 miles per hour.

19. The method of claim 16, wherein a velocity is outside a range comprising 8 miles per hour when the velocity differential is below 7.5 miles per hour or above 8.5 miles per hour.

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