SECTION 3

TRIPHASIC LACROSSE MODEL TRAINING COMPONENTS

3.1 The Triphasic Lacrosse Training Model Components

The Triphasic Lacrosse Training Model is created based on the application of specific stress. At the elite lacrosse level, each of the six physical performance qualities, along with the biomechanical considerations specific to the sport, must be accounted for to the highest extent. The concept of appropriate stress within this training model was already covered in the opening section of this manual. It will not be covered again here. However, it is vital every coach understands this idea and how specific stress must be applied to each of the six physical performance qualities. Once again, stress is the signal to the body that something has to change; something must adapt to reduce the amount of stress exerted by that stressor on the body if it were to ever come across the stressor a second time. It must be applied specifically and systematically for optimal performance to occur. The goal of training remains to create the graphic shown in Figure 3.1 below for each of the six physical performance qualities. This is achieved through training philosophies such as the block training model, modified weekly undulation training, and specific muscle action training. The training philosophies and programs implemented to create the Triphasic Lacrosse Training Model consider the specific stressors required to cause a physiological adaptation to each of the physical performance qualities. Only when this method is utilized can an appropriate annual cycle that leads to optimal performance in the sport of lacrosse be created.

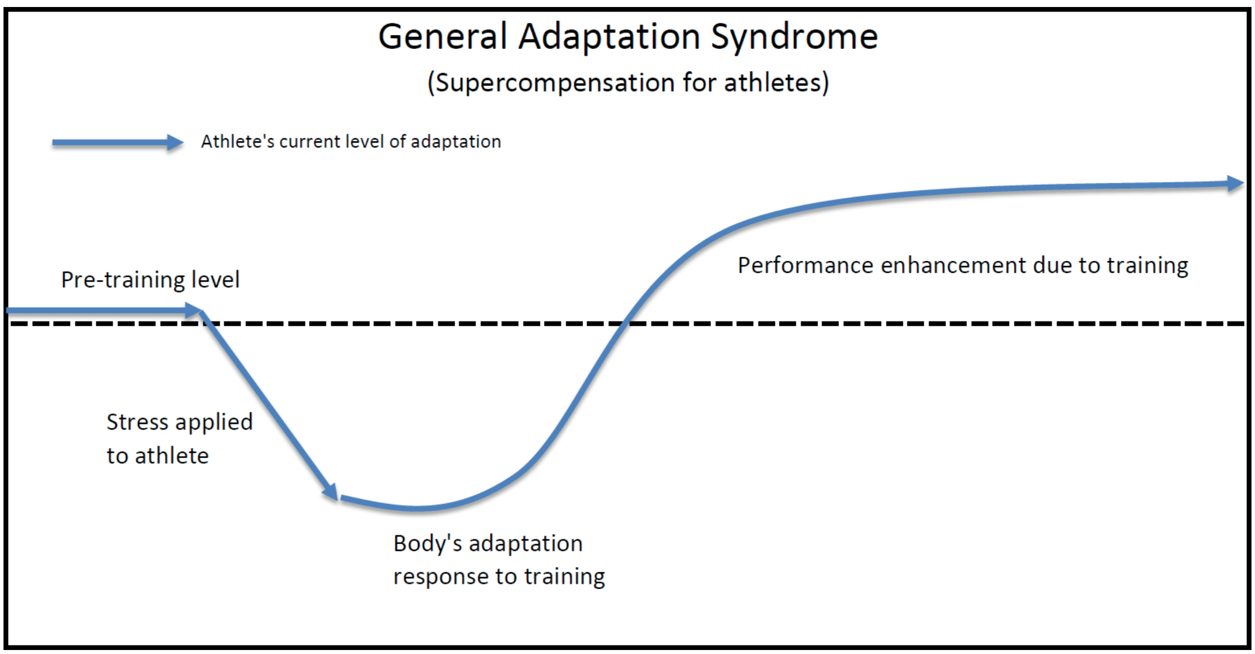

Figure 3.1 - Adaptation Response with Appropriate Stress in Training (Desired Adaptation)

3.2 Block Training Model

These specific stressors required in training to improve each of the six physical performance qualities (three energy systems, strength, repeat-power, and speed) must be completed in a systematic fashion. The block training model allows for the systematic training laid out in this manual to be completed in the most efficient and effective method possible. Only when specific stress through the block training model is applied to each of the six physical performance qualities can optimal performance be achieved at the desired times of the annual plan.

Achieving optimal performance for all athletes in the most efficient manner, concerning both time and energy expenditure, must remain a top priority for all performance coaches. This goal is exceeded in importance only by reducing injury during training and competition. The implementation of efficient training methods to gain and maintain optimal performance for an elite level lacrosse athlete is vital for success.

It is important that coaches also realize and understand that the perfect training model for any given individual exists only in theory. This is due to the dynamic systems theory and the realization that in order for a “perfect training model” to be executed all systems of the body, along with their reactions to each stressor, would need to be accounted for in a real-time setting. The effects of stressors, such as those in academia, personal life, monetary matters, or any other task or situation viewed as stressful to an athlete, alter his physiology in some way. A coach simply cannot account for all of these factors in an immediate fashion. Even though the perfect training model only exists in a completely controlled and understood world, an attempt should still be made by all coaches to create the ideal model for each individual athlete. The Block Training Model utilized throughout the Triphasic Lacrosse Training Manual is the clearest model available to ensure optimal performance whenever the call to action is needed.

3.21 Specific Stress

The Block Training Model of periodization is ultimately based on the principle of supercompensation, which is discussed in section one and is shown again above in Figure 3.1. To reiterate, stress is the signal to the body that something has to change; something must adapt to reduce the amount of stress exerted by that stressor on the body if it were to come across the stressor a second time. All athletes will respond to the stressors applied to them. The key is to provide the appropriate type and amount in order to drive a specific desired adaptation. Early in an athlete’s training, he is capable of adapting to multiple physical performance qualities at one time. This is due to his low ability to complete any of the six physical performance qualities to a high-caliber. However, as an athlete progresses and develops these performance qualities through training, the ability to adapt to multiple qualities is diminished. This is because higher levels of stress are now required to achieve changes in each physical performance quality.

This concept is demonstrated below in Figures 3.2 and 3.3. As a lacrosse athlete begins training, he is capable of developing each quality simultaneously. This is possible because each of these physical performance qualities begin at such low-levels, as shown in Figure 3.2. However, as the novice athlete progresses in his training and reaches the advanced stage, Figure 3.3, more specific stress must be applied to each of the performance qualities. Once an athlete reaches the advanced level, his qualities have all gained adaptations required of lacrosse to the point that they will not continue to improve without increased concentrated stress application to each of the six physical performance qualities on an individual basis.

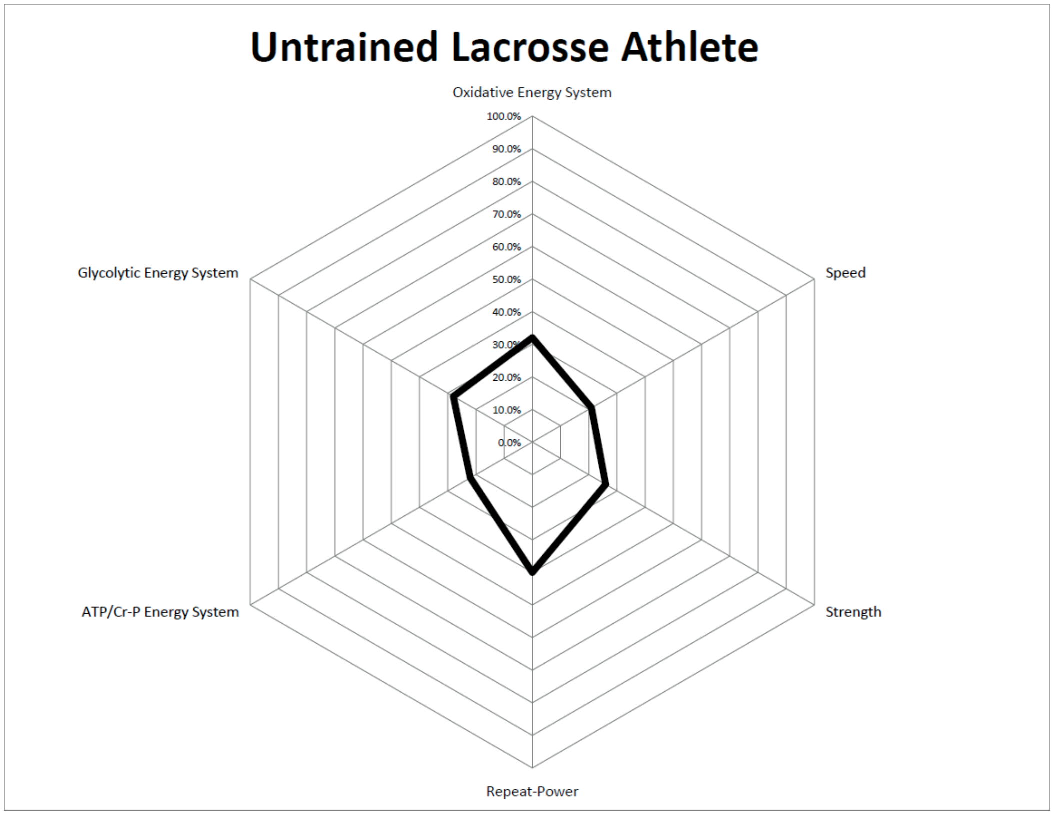

Figure 3.2 - The Six Physical Performance Qualities in an Untrained Lacrosse Athlete

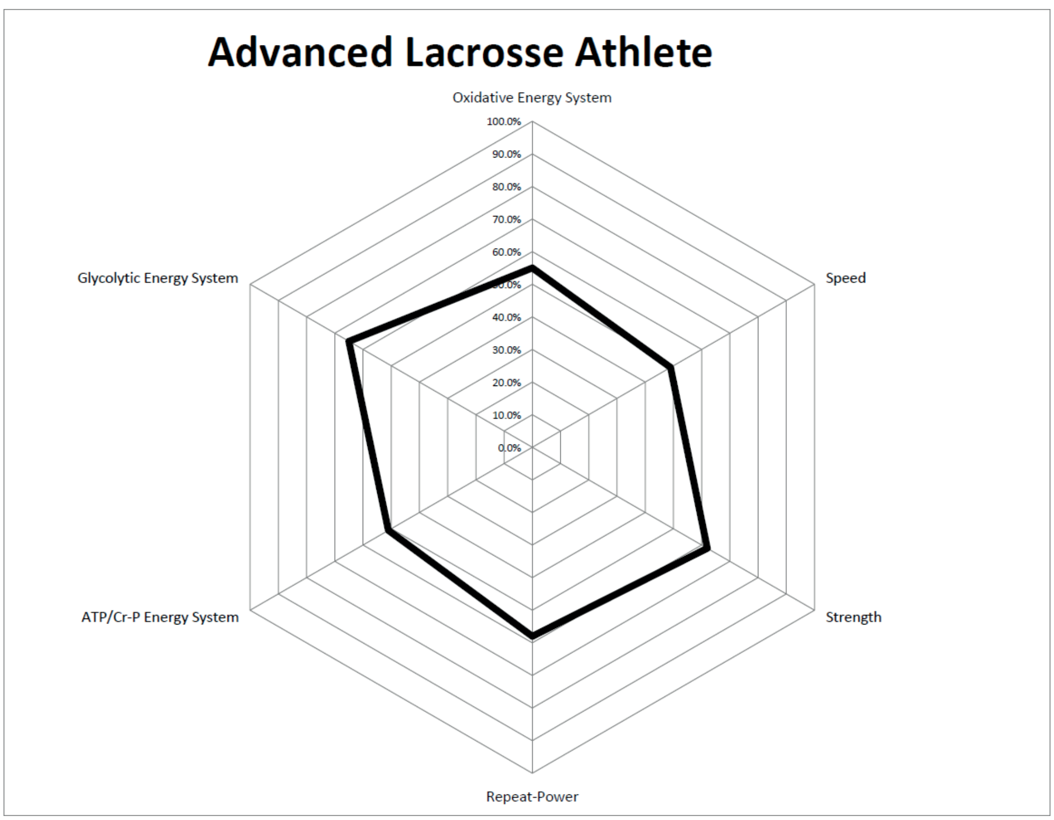

Figure 3.3 - The Six Physical Performance Qualities in an Advanced Lacrosse Athlete

It is this moment, the progression from untrained to advanced, that the concept of specific training through the Block Training Model should be implemented. As an athlete progresses in his training, more specific methods are required in order to achieve improvement in the six physical performance qualities. Rather than using multiple forms of stress and applying stress to multiple parameters at once, known as mixed training, the Block Training Model uses specific concentrated loads and focuses on one specific training parameter at a time. This concentration of stress based on the specific desired parameter allows the athlete's body to place focus on a single adaption, which greatly reduces the required time to maximize the adaption. Once the desired adaption is acquired, a new stimulus is implemented to improve a new, specifically chosen physical performance quality according to the systematic annual plan. This approach by block training allows all adaptions to be realized with the least amount of required volume, which means the individual will not experience as much "wear and tear" throughout training.

It is this idea that is a primary principle of the Block Training Model: stress the athlete specifically in order to elicit the maximal adaptations required for optimal performance for one physical performance quality, and then systematically train each of the six physical performance qualities. Only when these performance qualities are individually maximized due to the implementation of specific stress can an advanced lacrosse athlete truly become an elite level lacrosse player.

3.22 Residual Training Effects

Specific stress is one of the two primary concepts implemented in the Block Training Model. The other concept applied strategically within this model is the implementation of stress according to the residuals, or retention length, of each physical performance qualities. This concept of residuals allows a systematic approach to the training of each physical quality based on the duration at which the adaptation remains in a trained state once training is ceased for that specific quality.

Each of the physical performance qualities residuals are listed below in Figure 3.4. Through this figure, it becomes clear the oxidative energy system and strength performance qualities retain their adaptations for the greatest length of time. The glycolytic energy system and the repeat-power qualities have intermediate lasting residuals, with the ATP/Cr-P energy system and the speed performance qualities having the shortest residual lengths. The understanding of these residuals allows for a systematic program to be implemented, such as the Triphasic Lacrosse Training Model, which leads to optimal performance as each of the six physical performance qualities are improved to its required extent and then retained for specific competition periods.

DURATION OF RESIDUAL TRAINING EFFECTS (RTE) ON MOTOR ABILITIES			
MESOCYCLE	MOTOR ABILITY	RTE (DAYS)	PHYSIOLOGICAL BACKGROUND
ACCUMULATION	OXIDATIVE ENERGY SYSTEM	30±5	INCREASED NUMBER OF AEROBIC ENZYMES, MITOCHONDRIA, CAPILLARY DENSITY, HEMOGLOBIN CAPACITY, GLYCOGEN STORAGE, HIGHER RATE OF FAT METABOLISM
	STRENGTH	30±5	IMPROVEMENT OF NEURAL MECHANISM MUSCLE HYPERTROPHY
TRANSMUTATION	GLYCOLYTIC ENERGY SYSTEM	18±4	INCREASED ANAEROBIC ENZYMES, BUFFERING CAPACITY, AND GLYCOGEN STORAGE, HIGHER POSSIBILITY OF LACTATE ACCUMULATION
	REPEAT-POWER	15±5	IMPROVED AEROBIC/ANAEROBIC ENZYMES, IMPROVED LOCAL BLOOD CIRCULATION AND LACTATE TOLERANCE, REPEAT SPRINT ABILITY
REALIZATION	ATP/CR-P	5±3	ENHANCED RESYNTHESIS OF CR-P
	SPEED	5±3	IMPROVED NEUROMUSCULAR INTERACTIONS AND MOTOR CONTROL, INCREASED ANAEROBIC POWER

Figure 3.4 - Residual Lengths of the Six Physical Performance Qualities [38,47]

The knowledge of these residual training effects allows for a systematic approach to training that results in the simultaneous peaking of the six physical performance qualities to their appropriate amounts, which must be the goal for all coaches seeking optimal performance in lacrosse. By stressing and adapting these qualities with longer residuals first, the qualities with shorter residual training effects, such as speed, can be improved later on in the training cycle while the oxidative energy system and strength qualities remain elevated due to their long training residual effects. Performance coaches must also understand the importance previous training plays in regards to determining the length of time each quality is stressed. If a specific quality has been trained to a great extent previously, it will be regained by an athlete more rapidly than if it has not been previously trained. This consideration is critical for in-season training as each quality is re-introduced in training to ensure optimal performance is possible for post-season play.

3.23 Accumulation, Transmutation, & Realization

The consideration of residuals allows the Block Training Model to be broken down into three specialized training phases. These three phases have been termed accumulation, transmutation, and realization. Each phase is designed to build upon the adaptions from the previous phase and ultimately leads to the simultaneous peaking of all physical performance qualities as each progresses from general to specific training adaptations. Returning to Figure 3.4 above, the six physical performance qualities and how they fit into these three training phases can be seen. When applied to the sport of lacrosse, this progression allows an athlete to progress through the off-season training protocol beginning with more generalized training and finishing with the most-specific training just prior the competition season.

The accumulation phase can be thought of as the base phase, as its main goal is to build a solid foundation of the oxidative energy system and strength. The accumulation phase of training in the Triphasic Lacrosse Training Model consists of the energy system and strength qualities being maximized. This may seem confusing as Figure 3.4 shows the glycolytic and ATP/Cr-P energy systems as fitting into the transmutation and realization phases, respectively. However, this returns to the concept that without the improvement to each energy system, the other three qualities are not capable of being trained to the highest extent. Coaches should also understand the glycolytic and ATP/Cr-P energy systems will also be re-addressed in their respective training phases as they experience a smaller residual time than the oxidative energy system. Figure 3.5 below represents the residual training effects of the oxidative energy system and the strength physical performance qualities which are 30±5 days once specific training is ceased.

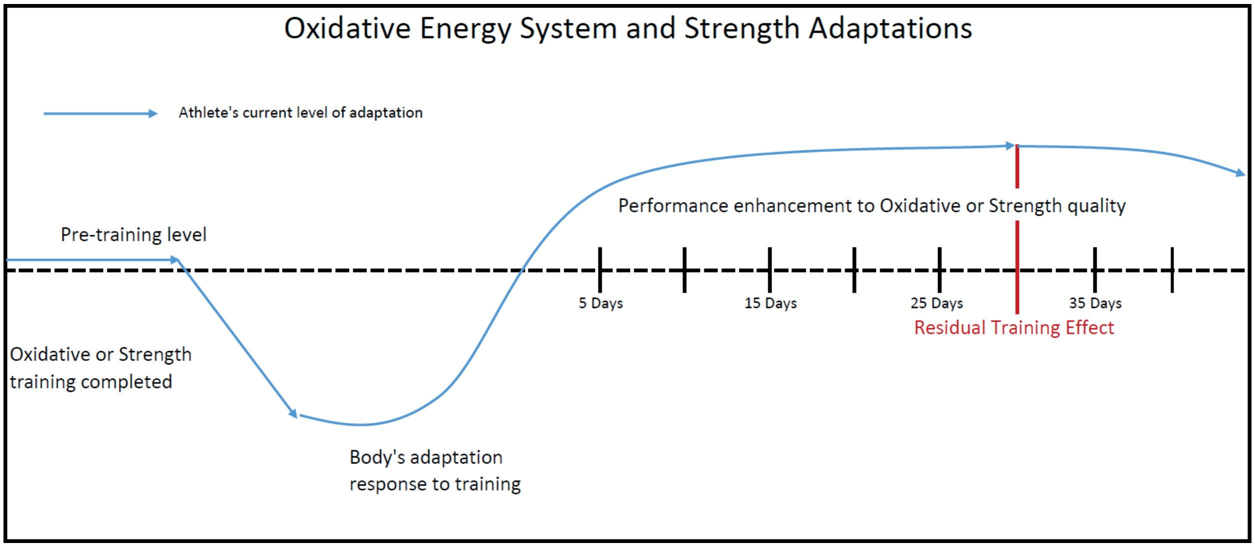

Figure 3.5 - Residual Training Effects of the Oxidative Energy System and Strength Physical Performance Qualities

These four qualities, the three energy systems and strength, form the foundation of all other abilities for a lacrosse athlete. That being said, the greatest amount of training time within the annual cycle is spent on developing these qualities to the highest extent. The development of basic abilities such as the ability to complete repeat, high-intensity efforts, general movement pattern learning, and muscular strength are all established during this phase.

Once an athlete has improved his foundational qualities in the accumulation phase, the transmutation phase is entered. During the transmutation phase, repeatable power becomes the primary adaptation goal of training. However, the glycolytic energy system required to repeatedly produce high-levels of power is also trained in this phase. Ultimately, an athlete utilizes his newly developed energy systems and strength, which were improved in the accumulation training phase, and learns to apply force repeatedly. This is an important skill as a lacrosse athlete must not only produce high-levels of force (strength), but he must be capable to produce these high-intensity efforts for the entire duration of the competition. Figure 3.6 shown below displays the residual training effects for these qualities, which are close to fifteen days.

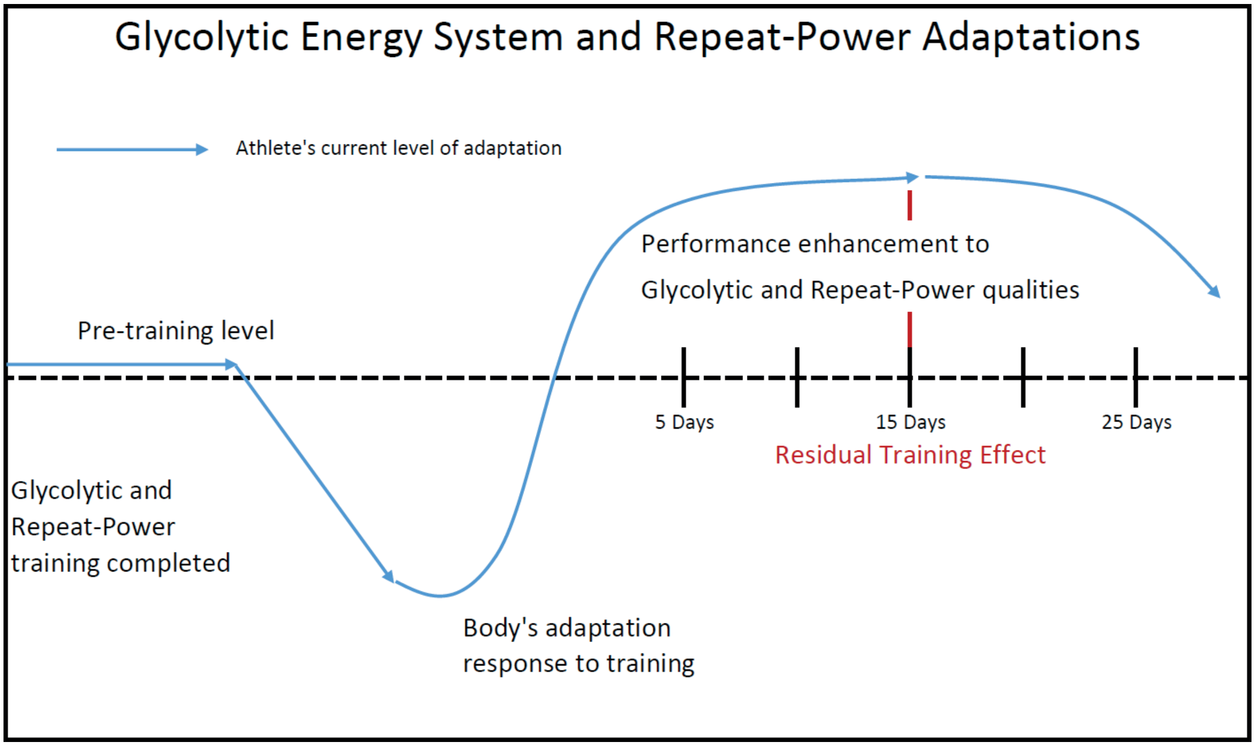

Figure 3.6 - Residual Training Effects of the Glycolytic Energy System and Repeat-Power Physical Performance Qualities

Finally, only when the other two phases have been completed, is the realization phase implemented. This phase can also be considered the peaking phase for an athlete as he trains in the most similar manner to the sport of lacrosse. In this training phase light-loads are utilized at the highest speeds possible. This is necessary as the sport of lacrosse is played at low-loads (body weight) and high-velocities. Through the implementation of this specific training, an athlete is trained to utilize his new force-producing capabilities (from accumulation and transmutation) in the most rapid, explosive manner possible. Figure 3.7 below demonstrates the extremely short residual training effects of these two qualities. With training adaptations maintained for a mere 5$\pm$3 days, these qualities must be trained near competition time to ensure they are applied in the game.

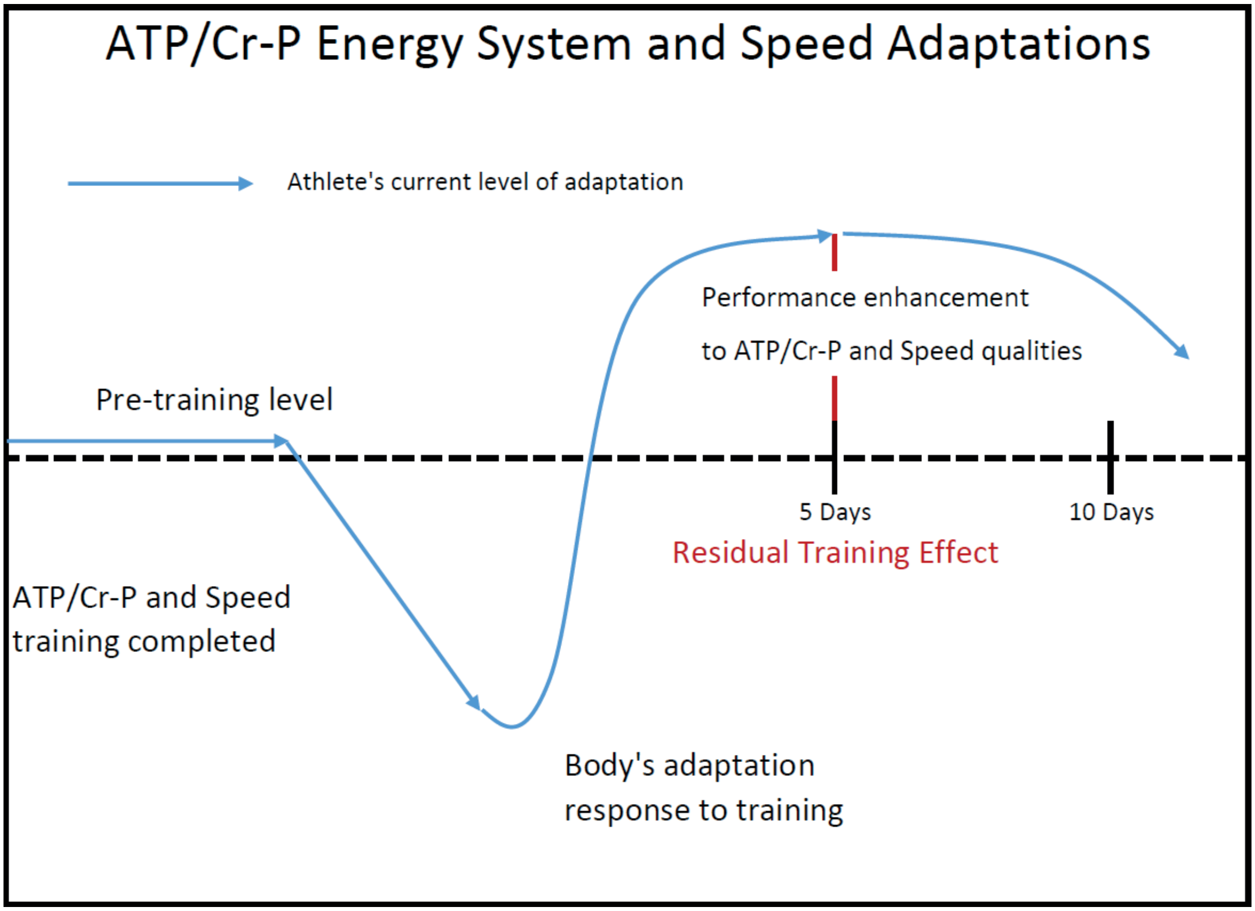

Figure 3.7 - Residual Training Effects of the ATP/Cr-P Energy System and Speed Physical Performance Qualities

3.24 The Force-Velocity Curve, RFD, and the Three Block Model Phases

It is clear that these three phases function in a systematic manner in which the most general adaptations occurring in the accumulation phase become more specific as training progresses through the transmutation phase and finally to the realization, or peaking, phase. Many coaches implement a form of strength testing prior to the competitive season. However, the force-velocity curve, as shown in Figure 3.8, demonstrates that maximal strength is actually the furthest skill from performing at an elite level in lacrosse. As force, or the load an athlete is lifting, increases, the speed of the movement decreases. An athlete will never complete a true one-rep max at high speeds, as this is simply not possible. The inverse also applies; as load is decreased closer to body weight, the speed a movement is executed at increases. This is why a bodyweight movement is completed at much higher velocities than a 90% back squat.

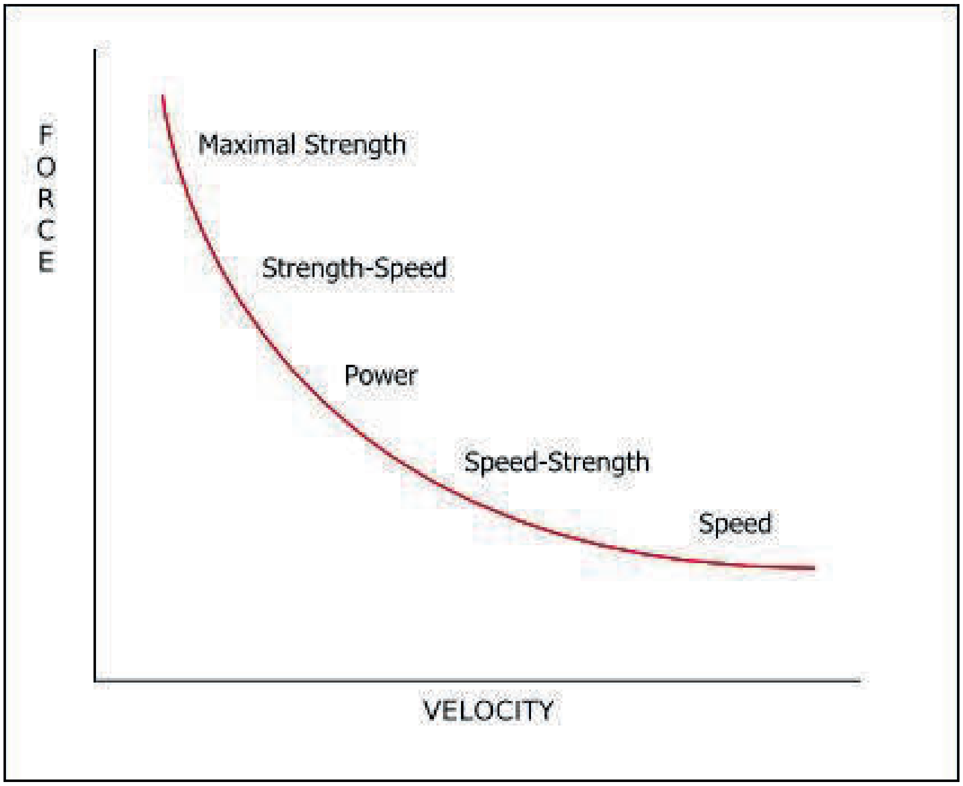

Figure 3.8 - The Force-Velocity Curve

As all coaches for lacrosse are aware, the game is played at extremely high speeds with relatively no increased weight, as only light gear is worn. This statement makes the speed component the most specific skill available for a performance coach to improve. This brings up the concept of rate of force development (RFD). RFD is critical for a lacrosse athlete and highly predictive of success [49-55]. RFD becomes important in the sport of lacrosse due to the limited time an athlete has to produce force. Sprinting as well as shooting are both simple examples to demonstrate the importance of RFD in lacrosse. During every stride taken while sprinting an athlete must apply high levels of force in an extremely brief amount of time. The ability to apply force through the foot rapidly is a crucial skill that must be maximized for a lacrosse athlete to experience success. The same principle can be applied to a shot. An athlete that attempts to produce maximal force levels during a shot will take far too long and will never get a shot off before a defender disrupts the play. An elite lacrosse player must be capable of generating high amounts of force in an extremely brief time period [2]. It is this skill that separates an advanced athlete from an elite one.

Virtually all athletic movements in sport are completed in under 250 ms. However, peak force is not typically achieved until sometime between 300 and 400 ms [50-53]. This means during any action completed in the sport of lacrosse, an athlete simply does not have enough time available to produce maximal force, or strength levels. This fact does not mean the quality of strength is not important, though. Every coach must remember strength lays the foundation for the speed/RFD quality, but strength cannot be the ultimate goal to create an elite lacrosse athlete.

The physical performance quality of speed or RFD cannot be increased to the fullest extent without first improving strength and power levels. The Block Training Model considers this and creates a systematic program, laying the foundation with strength, progressing to repeat-power, and then peaking an athlete with speed just prior to competition.

3.25 The Adaptations Realized in the Block Training Model

The adaptations to RFD realized by athletes through the implementation of these three phases of the Block Training Model are demonstrated below in Figure 3.9. The three lines depicted represent the RFD displayed as an average by a group of 40 athletes through a vertical jump test after different training phases. The time axis in this figure is intentionally cut at 250 ms, as virtually all lacrosse movements are completed in under this amount of time. By ending the axis at this time, the true performance ability of the RFD can be measured for a large group of athletes.

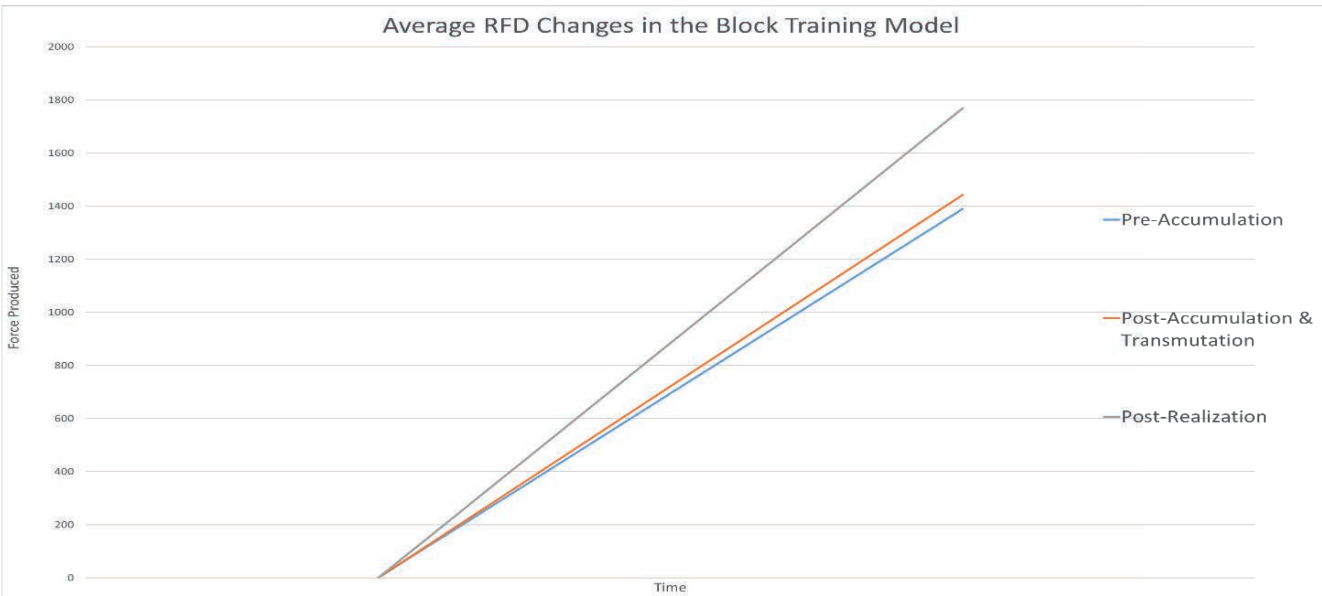

Figure 3.9 - RFD Adaptations Due to the Three Phases of the Block Training Model

The blue line at the bottom represents the "Pre-Accumulation" test. This vertical jump was completed prior to the training of any phase and should be utilized as a true baseline of performance.

The orange line represents the "Post-Accumulation & Transmutation" test. This test was executed after the three energy systems, strength, and repeat-power physical performance qualities were trained. This test was completed after a long duration of training. It is important to remind coaches again that the time axis is cut off at 250 ms. Athletes are capable of producing much higher levels of absolute force after the training of these performance qualities. However, they are not able to translate them as rapidly as required in the sport of lacrosse.

Finally, the grey line represents the "Post-Realization" test. This test was implemented a mere three weeks after the "Post- Accumulation & Transmutation" vertical jump test. Through the specific training at low-loads and high velocities, it becomes apparent an athlete "learns" the ability to produce high-levels of force in extremely brief periods of time. This is the most specific training possible to be completed for lacrosse, other than practicing the sport itself.

It is critical all coaches understand the importance of each physical performance quality in regards to lacrosse. Based on the adaptations presented in Figure 3.9, a few key concepts become clear. First of all, the realization that these results represent the adaptations to a large scale group of athletes must be made. These results do not demonstrate the adaptation of a single athlete to a program, these are proven results on a continual basis. Some athletes may respond to a greater or lesser extent to this program and require minor tweaking to achieve optimal performance. However, every athlete will demonstrate adaptations to the specific physical performance quality being targeted in training. The second important takeaway from this graphic is the implementation of all three phases to optimize performance. Based on Figure 3.9, some coaches may consider jumping straight to the realization training phase and skipping over the accumulation and transmutation phases. This is the biggest mistake one could make. The realization phase adaptations are only capable of being attained when the other two phases have been trained to the highest extent. This returns to the pyramid demonstrated in previous sections, with strength laying the foundation to repeat-power, and then finally speed. The realization phase is just the icing on the cake to “peak” an athlete for competition. Without the other two phases optimal performance will never be possible.

The concept that all three phases, accumulation, transmutation, and realization, play an important role in RFD has been consistently stated throughout this section. The importance of each phase of the Block Training Model becomes apparent when the “biphasic” manner of RFD as well as the specific physiological adaptations required to achieve maximal RFD abilities are understood.

The biphasic manner of RFD means two phases or components are required to maximize the ability of an athlete to produce the highest levels of force in minimal time. RFD is broken down into the early and late phases. The early phase occurs in an extremely brief time period and relies on the drive of the central nervous system (CNS). The late phase of RFD is dictated by the production of force and is more closely related to the maximal force production capabilities of the athlete.

The early phase of RFD is improved through neural improvements to the body. These adaptations include motor learning, the reduction of co-activation, recruitment, rate coding, and muscular synchronization. When all of these nervous system qualities improve, athletes are better able to coordinate the activation of fibers in single muscles as well as in muscle groups, leading to maximized RFD abilities [(51,56-61)].

The late phase of RFD is improved through the improvement of maximal force production. Specific adaptations to this phase include improvements in the contraction steps, the training of the muscle spindles, golgi tendon organs (GTO’s), and renshaw cells, as well as the increased functioning of the sarcoplasmic reticulum [(50,51,62)].

Each of these two phases of RFD are affected by different training methods. The early phase of RFD achieves the highest adaptation levels through explosive, high-velocity training, which increases the neural drive of an athlete [(49,50,52,54,63)]. Training which implements the use of high-loads leads to the increase in maximal strength or force production. These movements are completed slower and allow enough time for high levels of force to be achieved, which improves the late phase of RFD [(52,53,63)]. Although higher load training improves the late phase of RFD, the early phase of RFD can also see improvement when the load is accelerated and moved as rapidly as possible. This is due to the high neural drive created in this technique. For this reason an athlete should always attempt to move the bar concentrically as rapidly as possible, regardless of the load utilized. Although improvements are seen to the early phase of RFD when high loads are moved as rapidly as possible, the highest adaptations to the early phase will not be realized unless low loads and high velocities are implemented in training.

Clearly, RFD is the product of many adaptations including neural, strength, and muscular activation patterns and also co-activation. However, this section is simply an introduction to the adaptations achieved through different training methods implemented within the Triphasic Lacrosse Training Model. If you wish to read more into these specific adaptations in greater detail, click here. Only when these adaptations are accounted for at the appropriate times can optimal performance by a lacrosse athlete be produced.

Each of the three phases in the Block Training Model leads to necessary adaptations; if left untrained, RFD to the highest extent would not be possible. The accumulation phase trains an athlete to generate the highest levels of force production as loads of greater than 80% are implemented. The transmutation phase then teaches an athlete to produce power outputs continuously, as 55-80% is utilized in training. Finally, the realization phase implements low loads at the highest velocities. Training implemented is below 55% of one-rep max with the goal of completing repetitions as rapidly and explosively as possible.

The Triphasic Lacrosse Training Model, through the implementation of the Block Training Model, considers both the early and late phase of RFD and individually enhances them through strength and speed training to maximize performance in each of both of these phases. Each of these adaptations required to maximize RFD are considered in a systematic fashion according to its residual training effects described above. This specific order begins with muscular improvements and then translates those adaptations so they can be applied rapidly in the early phase of RFD. As the competition period approaches, focus of training must be shifted to the early phase in order to optimize transfer of training and performance.

Ultimately the goal of every performance coach returns to three concepts. These include appropriate stress, injury reduction/prevention, and transfer of training. When each of these are applied in a training program optimal performance in the sport of lacrosse is possible. The Block Training Model considers and implements appropriate transfer of training to a greater extent than any other model available currently. The Block Training Model progresses from general to the most specific physical performance qualities required in lacrosse, all while considering their residual training effects.

3.3 Modified Undulated Training Model

The Modified Undulated Training Model represents a smaller scale of the Block Training Model. The Block Training Model considered training completed based on specific desired adaptations on a large-scale basis. This model builds from The Block Training Model in that it focuses on providing a specific stimulus, or stress, on a daily basis. The Modified Undulated Training Model takes the stressors placed on each athlete in training on a daily basis into account based on the intensity and volume. By considering these factors an athlete experiences, an optimal weekly training model can be created and implemented.

The Modified Undulated Training Model has been created based on the Classic Undulated Training Model, which progressed in intensity and decreased in volume throughout the training week. This periodization model is shown below in Figure 3.10 and allowed great success within Bulgarian users in the past. However, this model is not feasible for a lacrosse athlete. The athletes seeing tremendous results while implementing this method demonstrated in Figure 3.10 were also utilizing anabolic steroids. This enhanced their recovery time, allowing them to recover at much faster rates than non-performance enhancing drug users.

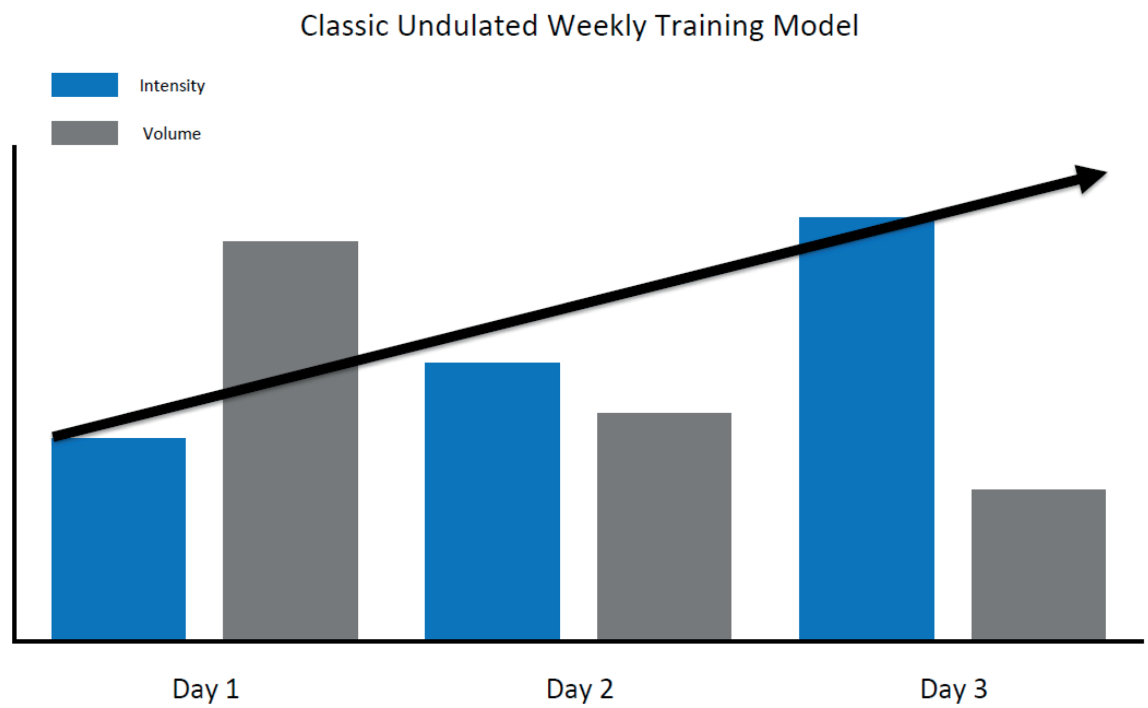

Figure 3.10 - The Classic Undulated 3-Day Training Model

Athletes not utilizing drugs simply cannot recover from the high-volume training at the beginning of the week and be capable of performing at high-levels for the remainder of the week. In other words, the Classic Undulated Training Model over trains drug-free athletes and leads them to decreased sport performance. Returning to section one, this is a scenario where excessive stress is applied and an athlete is never allowed to recover. This ultimately leads to a decrease in lacrosse performance.

As all performance coaches have the common goal of creating the most powerful and efficient athlete possible, the Classic Undulated Training Model is clearly not appropriate. For this reason, the Modified Undulated Training Model was created and implemented. This modified model takes each of the days from the Classic Undulated Model and shifts them one day to the left. Figure 3.11 below demonstrates the weekly loading of the Modified Undulated Training Model.

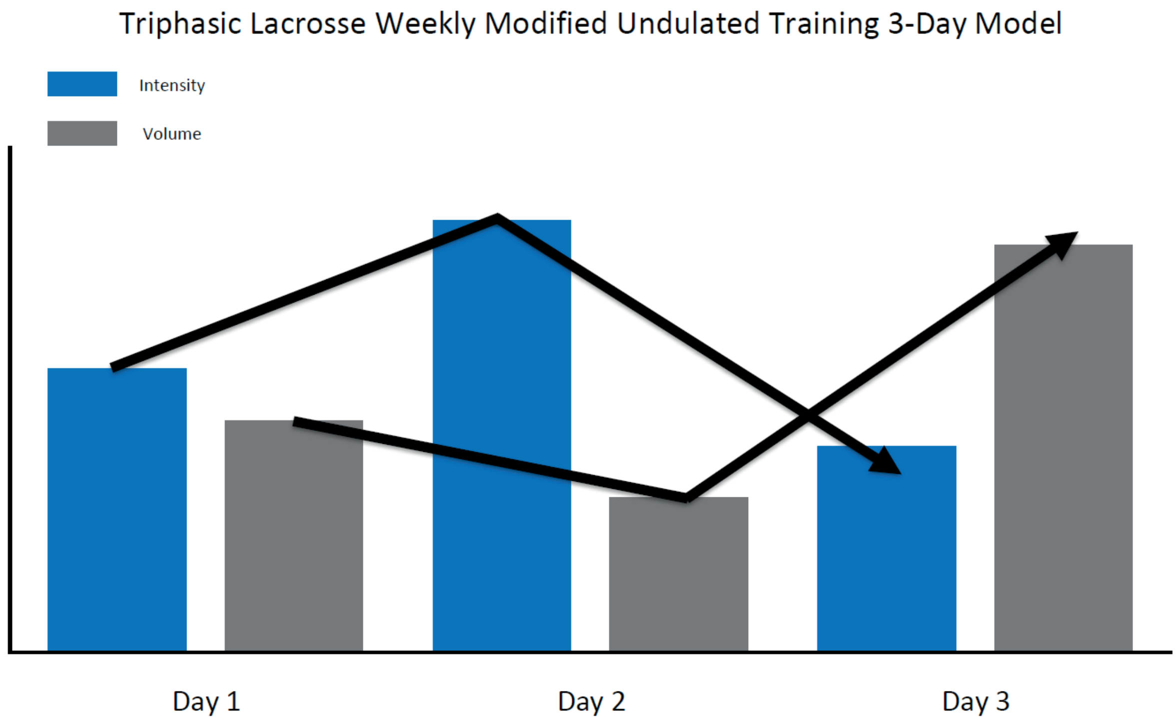

Figure 3.11 - The Modified Undulated 3-Day Training Model

By shifting the days in this fashion, the high volume work is pushed to the end of the training week, (Day 3). This allows sufficient recovery time over the weekend prior to training beginning the following week. This recovery time is critical as volume is the most difficult training aspect an athlete is required to overcome. This model further allows high-quality training to be completed as the highest intensity training day is placed in the middle of the week (Day 2 in Figure 3.11). By placing the high-intensity, low-volume training in the middle of the week, athletes take advantage of the neural priming that takes place due to the moderate-intensity completed on Day 1.

As shown above in Figure 3.11, the Modified Undulating Training Model implements a weekly program in which the first training day of the week is a moderate-intensity, moderate-volume day. The second training day is a high-intensity, low-volume day, and the final training day of the week is a low-intensity, high-volume day. By taking the two factors of intensity and volume into account, the overall load placed on an athlete can be controlled and programmed for according to the body's response to stress within each weekly cycle. By considering the hormonal response and change in readiness to every athlete throughout the week, due to the idea that remaining stress from a previous training session plays a role in future training and the body's response, The Modified Undulating Training Model is able to increase quality of training to the fullest extent.

As an athlete progresses through the weekly training cycle, the more likely his ability to perform high-quality work will be diminished due to the accumulation of fatigue. High-quality work and its importance is a concept that will be discussed in greater detail in the upcoming section. However, it should be understood that the goal of training must be to improve the amount of quality work that can be completed by each athlete. The longer an athlete can maintain and complete high-quality efforts, the greater the likelihood that improvements will be seen in performance.

Returning to the concept that volume, due to the tissue stress, is more difficult to overcome than intensity, the Modified Undulated Training Model creates a minimum of 72 hours between volume-based training days (Days 1 and 3 in Figure 3.11). The Modified Undulated Training Model can be easily implemented in a 5-Day weekly training model and is demonstrated below in Figure 3.12.

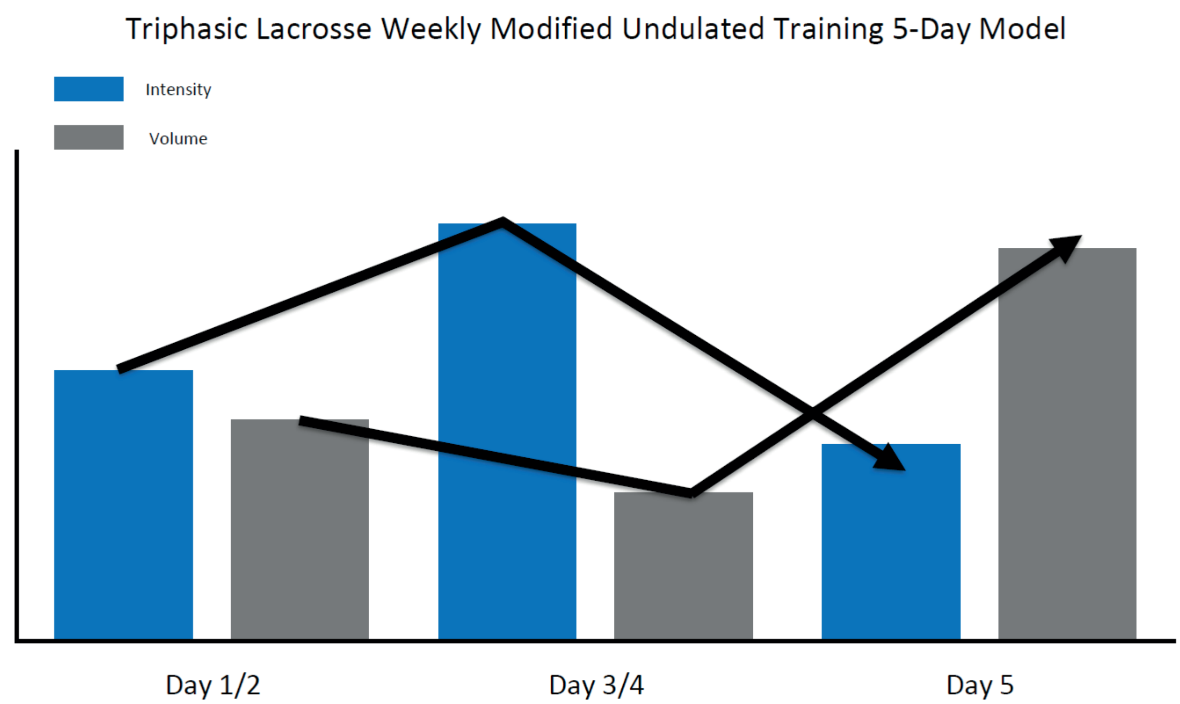

Figure 3.12 - The Modified Undulated 5-Day Training Model

By modifying the classic undulated program and shifting the highest volume day to Friday had enormous benefit for two very important reasons. First, the higher volume at the end of the week took on a small role as an active recovery day, forcing blood and nutrients into the muscles to help speed recovery. Secondly, and more importantly, it allows for individuals to be pushed a little past their physical limits. With 72 hours to rest before the next training session on Monday, an even higher level of stress can be implemented than that seen with the classic model. This allows individuals to overreach each week, leading to supercompensation at a level not seen in any other model, all while considering the quality available to an athlete. It is important to note this model is only implemented in the Triphasic portions of training. This model allows the most specific stress possible to an athlete, thus it is implemented in training as the season approaches. As outlined in section one earlier, the appropriate application of stress is necessary to elicit supercompensation, and supercompensation is a key component of achieving optimal performance in the most efficient manner.

3.4 High-Quality Training Model

Based on the requirements of the sport of lacrosse described in sections one and two, all performance coaches should understand the importance of both capacity and quality training. Every athlete must be capable of producing repeated bouts of high-intensity of work in order to improve his odds of being successful in competition. Much of the energy system training implemented in the Triphasic Lacrosse Training Model is executed to improve the capacity of the athlete. This can be seen in the fact that athletes, upon completion of this block, have the ability to complete a greater number of repetitions before great performance decrements are seen. However, the ability of that athlete to produce higher power levels, or quality, has not been improved to a great extent. Once training of the energy systems has been completed, the majority of training should be implemented to improve the quality an athlete is capable of producing. Ultimately, the energy system training has improved the efficiency of the athlete, but the remainder of training must be focused on improving the power output of the athlete. Only when these are both considered individually, as the Block Training Model allows, can optimal performance in lacrosse be possible.

The Modified Undulated Training Model, described above, accounts for some of this quality of training through the consideration of specific training intensities and volumes and their placement within the weekly cycle. However, other methods are implemented within the Triphasic Lacrosse Training Model to ensure training of the highest-possible quality is completed. These other methods include the utilization of timed sets and the implementation of drop-off sets.

In the High-Quality Training Model utilized throughout the Triphasic Lacrosse Training Model, sets are no longer defined by a number of prescribed reps. Instead, the athlete performs as many reps as possible in a specified time frame. This allows for a greater density of training, as well as energy specific training based on the requirements of the sport. As described in section two, lacrosse consists of short, intense work bouts followed by moderate rest periods. By manipulating timing parameters rather than reps, it is possible to train the energy systems specifically to those required of a lacrosse athlete while also improving force production (64).

For the highest quality of training timed sets of no greater than ten seconds are utilized, with brief rest periods given between all sets. Timed sets greater than this ten second duration lead to reductions in ATP/Cr-P energy system availability, which reduces training quality. Timed sets of this time also maximize neural drive and force an athlete to accelerate the load as rapidly as possible, leading to adaptations to the early phase of RFD. Brief rests in between sets reduce energy utilization by allowing the ATP/Cr-P energy system to recover slightly while also enhancing muscle building properties. These brief rests allow high-quality training to be maintained for the duration of the training session.

In order to train for max speed, which is the highest quality skill, training must be done at, or near, maximal speed. For this reason, excessive volume can become a negative transfer to the quality of training (64,65). Any increases in volume should come from increasing work rate within the set rather than an increase in time. For example, if an athlete gets seven repetitions in five seconds in the first week and then gets nine repetitions in five seconds in the second week, it is clear that the athlete has progressed. Progression during timed sets is derived from increasing work rate, or the density, within the set rather than altering the specified reps.

Hormonal responses of athletes can also be accounted for by utilizing timed sets in the High-Quality Training Model. By keeping all sets under ten seconds and allowing for brief rests between sets, an athlete can be kept below his lactate threshold and avoid high-levels of cortisol release. This goes hand in hand with energy system specific training seen in The High-Quality Training Model. It is important to note an athlete will absolutely cross the threshold and begin cortisol production throughout a training session. However, if an athlete can train at the highest qualities for a greater amount of time, his adaptations specific to the sport of lacrosse will be maximized in a fashion similar to the requirements of competition.

This training model can be applied directly to the Modified Undulated Training Model described above, with Day 1 sets being completed at seven seconds each, Day 2 sets being five seconds, and Day 3 sets being completed at ten seconds. This follows the guidelines of the Modified Undulated Weekly 3-Day model laid out in Figure 3.11.

The second concept applied within the High-Quality Training Model is the idea of drop-off sets. Those familiar with any velocity based training techniques may understand this method. However, if you are not, this is the concept that an athlete complete a movement, or series of movements, until a specific drop-off in speed is achieved. To put this into perspective, if a 10% drop-off is being applied and an athlete is moving a load at 1.0 m/s, they will continue to complete the movement as programmed until they can no longer execute the load at 0.9 m/s. That change in 0.1 m/s represents a 10% change in the velocity of the load being moved by the athlete, thus the exercise is completed.

Many coaches do not have the budget available to track bar speed for multiple athletes. In this instance a countermovement jump with no arm swing can be applied to measure the drop-off of the athlete's nervous system after each set. The same principles of the drop-off can be applied to this jump method as above. If an athlete's maximal vertical jump is measured at 24.0 inches, they have completed the exercise, or set of exercises, when they can no longer jump above 21.6 inches. This again represents a 10% drop-off in performance.

Drop-off sets are critical to prevent excessive training volume, which reduces quality and blunts the desired adaptations [(65)]. When two groups of athletes completed identical training programs, other than the drop-off required prior to the cessation of training, major differences in desired adaptations were seen [(65)]. One group completed a 20% drop-off, while the other continued to train until a 40% drop-off was achieved [(65)]. Although these two groups achieved similar strength gains, the explosive type IIX muscles of the 40% drop-off group were decreased [(65)]. These explosive type IIX fibers remained unchanged in the 20% drop-off training group [(65)]. Excessive volume has the ability to negatively affect the ability to produce explosive movements, such as those required in lacrosse [(65)].

In this training manual the greatest drop-off implemented is 10%. Although it is not always apparent that the drop-off method is being implemented, it is critical to note that in the many years of implementing the Triphasic Training System, four sets of a major mover and French contrast methods have proven to achieve the 10% drop-off in almost every athlete tested. These methods will be shown and described in the upcoming section.

Many other programs utilize excessive volume in training, such as sets of eight, or even ten repetitions. These programs are not focused on the quality of training the athlete achieves and place a greater emphasis on the capacity aspect. There are times to utilize these higher repetition schemes for motor learning and general strength, as demonstrated in the early phases of the Triphasic Lacrosse Training Model. However, as competition time approaches, athletes must be trained according to the specific desired adaptations. Remembering the goal of achieving optimal performance for a lacrosse athlete in the most efficient manner possible, the Block, Modified Undulated, and High-Quality Training Blocks must be implemented by performance coaches.

3.5 Triphasic Muscle Action Training Model

The final training model implemented in the Triphasic Lacrosse Training Model is the individual training of the three muscle actions. These three phases form the origination of the term "Triphasic." These muscle action phases, the eccentric, isometric, and concentric, are present in all dynamic movements. This means that every action completed in the sport of lacrosse requires each of these three movements to some extent. This concept was demonstrated back in section one of this manual in the multi-dimensional training section. With every stride taken, whether that is completed in a walking or running fashion, the glute should experience eccentric loading, an isometric transition, and then a concentric push-off. The ability to utilize each of these muscle action phases becomes even more critical in high-speed movements, as seen in lacrosse. When each of these movements are utilized, they create the SSC. The SSC, which was described earlier in the shooting portion of section two, is utilized during every movement in lacrosse and is one of the most important abilities any athlete can improve. This skill is critical as it is both a source of power production, and also efficiency for the lacrosse athlete. For this reason, one of the primary goals of Triphasic Training is to optimize the SSC through the individualized training and improvement to each of the three muscle actions.

Prior to the specific implementation of muscle action training implemented in the Triphasic Lacrosse Training Manual, every coach must fully understand what an eccentric, isometric, and concentric muscle action truly represents. An eccentric muscle action is one in which the muscle is forcefully lengthened. On the other hand, a concentric muscle action is one in which the muscle is shortened while overcoming force. Between these two phases is the isometric phase of dynamic movement. This phase can be thought of as the transition phase between an eccentric and concentric muscle action and occurs extremely briefly. For this reason, the isometric phase is commonly overlooked.

As described above, every movement completed on the lacrosse field requires these three muscle actions to be completed in an explosive manner. The ability to change direction represents a simple example of the implementation of these three phases in action. For example, an attack athlete catches a pass running downhill toward his defender at near maximal speed. This attackman then executes a dodge by planting his right foot into the ground and the crossing the defender's face to create a prime scoring chance.

During this maneuver that all lacrosse players learn at some point, each of the three muscle actions are not only demonstrated, but completed at a high-velocity. As the attackman plants his right foot into the ground it must absorb the high-force levels due to the speed of the completed dodge. This force should be absorbed through the entire kinetic chain up to the hips and glutes, as described previously in both sections one and two. The athlete must then be capable of transferring these high-force levels in the new desired direction, in this case, across the defender's face and toward the goal. Finally, the athlete must apply this "stored" force concentrically in order to drive out of this position and blow past the defender. The training and utilization of these three phases has allowed this attackman to create a high-percentage scoring opportunity.

If this athlete did not have the eccentric ability to absorb the high-levels of force or the isometric strength to transfer this force in the new direction, he would have been slower out of his dodge. The athletes that lack these two phases of training are the ones who get "stuck in mud" as they complete an explosive movement. Their bodies are not able to absorb and transfer the high-force levels required. Thus, they must dissipate this energy in another manner throughout their kinetic chain. This refers back to the ankle example in section two. If one link within the kinetic chain is not able to absorb, transfer, or apply high-levels of force, energy will "bleed" through this weak portion of the body. Ultimately, this leads to inefficient movement and increased injury risk. The importance of these muscle action phases cannot be overlooked in training.

As stated in section two, the athlete's body, when utilizing the SSC to the highest extent, functions as a rubber-band. As his body absorbs force in any action he experiences a stretch. If he is able to absorb and transfer this stretch across his kinetic chain, he is able to produce greater amounts of force by "snapping" his stretched rubber-band back to its resting position. This is demonstrated above in the dodging example that all lacrosse athletes complete at some point in their career. However, these muscle action phases are utilized in every movement on the lacrosse field, as shown with the shooting example in section two, and must be trained for accordingly. This is not new information to many coaches; however, the individualized training of the eccentric and isometric phases is typically left out in so-called "specific" training programs.

In programs that do not train the eccentric and isometric muscle action phases specifically the concentric phase gets all the glory in training. This occurs in many programs as it is the concentric phase that is utilized to determine an athlete's RFD capabilities. However, the importance of the eccentric and isometric phases in training cannot be overstated, as without the ability to absorb and transition high-levels of force, an athlete will execute movements inefficiently and with a reduced power output. This ultimately leads to suboptimal performance in lacrosse.

Figure 3.13 below depicts these three phases of dynamic movement. The line on the left side of the "V" represents the eccentric phase, where the athlete is absorbing force. On the right side of the "V" is the concentric phase, or the force-producing phase of movement. The isometric phase occurs briefly at the very bottom of the "V," as it is the moment of transition between the eccentric and concentric muscle action phases. As already hinted, when these three phases are combined a "V" is formed. Performance coaches must understand the steeper the "V," the greater RFD produced by an athlete, as he is producing greater amounts of force in a smaller amount of time. However, the aspect commonly missed is the fact that the concentric portion of the "V" will never occur at a steeper slope than that of the eccentric. An athlete will never be capable of producing what he cannot absorb. By improving an athlete's ability to absorb high levels of force eccentrically, his ability to produce power concentrically is maximized. This directly causes an improvement in RFD, which is vital in the sport of lacrosse.

In Figure 3.13, it becomes clear the elite athlete, or the athlete dodging in the example above, has an advantage based on his ability to absorb and produce force in a much more rapid fashion. This elite athlete does not get "stuck in mud" and is ultimately able to demonstrate a greater RFD due to his ability to absorb higher force levels. This athlete will also execute every movement with greater efficiency as he is capable of producing more power from his SSC. By training the muscle action phases individually and specifically, an athlete not only produces greater power outputs, but he does so all while expending less energy than a non-Triphasic trained athlete.

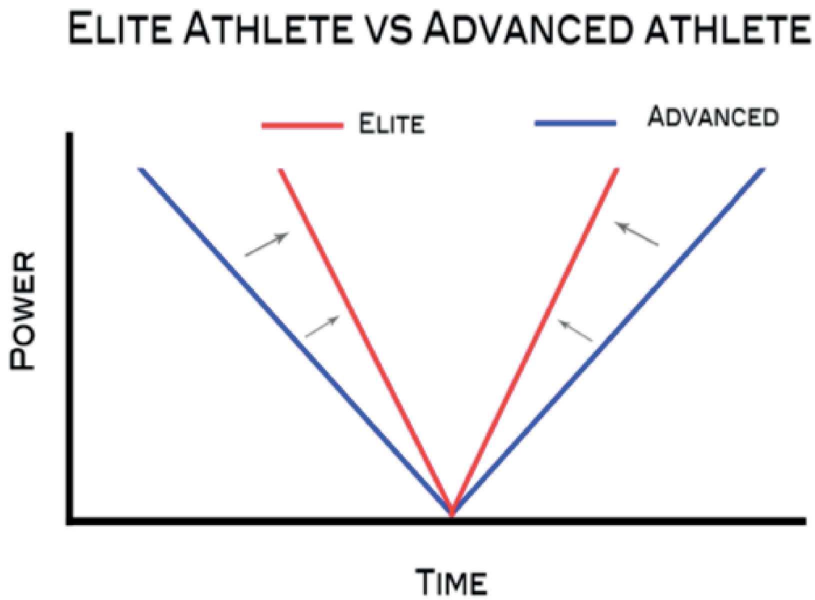

Figure 3.13 - Force Absorbing and Producing Capabilities of an Elite and Advanced Athlete

The ability of an athlete to absorb, transfer, and re-apply maximal force efficiently through every dynamic movement completed is critical for elite-level performance in lacrosse. Only when the eccentric, isometric, and concentric muscle action phases are trained individually can the greatest improvements be achieved. The Triphasic Lacrosse Training Model takes each of these muscle action phases into account and trains them to the highest extent. Only when these are trained individually, is optimal performance possible.

3.51 Eccentric Muscle Action Training

As described above, each of the three phases of every dynamic movement are trained individually within the Triphasic Lacrosse Model. Not only does the improvement of the eccentric muscle action phase improve the SSC, but it also improves the stretch-reflex and trains explosive muscle specifically, when implemented appropriately. Each of these adaptations leads to an improved ability of an athlete to absorb high-levels of force.

The stretch-reflex is a powerful reflex within the body. It is composed of two proprioceptive sensory signals: muscle spindles and golgi tendon organs (GTOs). Muscle spindles are responsible for sensing a length change within the muscle, while the GTOs sense changes in muscle tension [66]. As a muscle experiences a change in length, the muscle spindle, which is located within the muscle, relays the position of the limb CNS and is then responsible for regulating the contraction force produced by the muscle. Ultimately, as the muscle experiences a stretch, the muscle spindle must activate the appropriate number of muscle fibers in order to create and apply the required amount of force.

GTOs, which are located on the origin and insertion of the muscle and into the tendon, then sense this tension change throughout the muscle. If the tension experienced by the muscle is determined to be too high, the GTOs relay information for the muscle to relax [66]. This act is completed to prevent any potential injury, as the GTOs feel the muscle is not capable of producing enough force to overcome the stretch being experienced. In section one, the importance of rate of force acceptance was introduced for injury reduction. This concept relates directly to the muscle spindles and GTOs. As an athlete's body experiences an eccentric muscle action, particularly at a high velocity as seen in lacrosse, the muscle spindles must be activated rapidly to a high extent in order to overcome this stretch. However, the GTOs must remain in a "deactivated" state if the athlete is to produce the movement as powerfully and efficiently as possible.

As GTOs are commonly overprotective of the force experienced by the body, it is imperative a training program is implemented to "teach" the GTOs that the muscles are truly capable of overcoming these high forces successfully. Through the implementation of eccentric training, the inhibitory effect of the GTOs is decreased, while the response of the muscle spindles is increased [67]. This leads to improved neuromuscular synchronization between these two aspects of the stretch-reflex and the CNS, allowing an athlete to eccentrically absorb increased force levels in movement. This is critical as the athlete capable of absorbing higher force levels will be able to produce higher levels of concentric force through the use of the SSC. Ultimately this leads to maximal levels of force production in the most efficient manner by every athlete.

Eccentric training is also vital as the muscle action is completed differently on a physiological level. The majority of performance coaches understand the size principle in regards to muscle recruitment patterns. This principle states that the body will only activate the muscles required in order to complete the task at hand. As the required force levels increase, whether that be through increased load or velocity, a greater number of muscles are recruited in order to execute the movement. This allows every action to be completed in the most efficient manner possible, as unnecessary, powerful muscle fibers are not recruited and utilized unless absolutely necessary.

However, the eccentric muscle action utilizes a different strategy of muscle recruitment and does not follow the size principle as described above. During eccentric movement even fewer muscles are recruited, meaning there is greater stress being placed on those activated muscles than during the isometric and/or concentric phases [67-69]. Although fewer muscles are being utilized during this muscle action phase, the eccentric component of movement has a much greater force producing capability than both the isometric and concentric muscle action phases. This is because the explosive, type II muscle fibers are selectively recruited prior to the weaker, more aerobic muscle fibers [68,69]. Eccentric muscle actions take the size principle and reverse it as the most explosive fibers are recruited first, rather than last [68,69]. Performance coaches witness this in training every day. An athlete is capable of using much more weight if he is only required to slowly, eccentrically lower a squat down to the bottom position, than if he is required to concentrically stand back up with the load.

This is demonstrated in Figure 3.14 below. The force-velocity curve was shown earlier in this section during the Block Training Model portion. However, that figure demonstrated only the concentric muscle action phase, which is now shown in green in Figure 3.14. Clearly, the eccentric (red) and isometric phases are able to produce significantly higher force levels than the concentric muscle action phase.

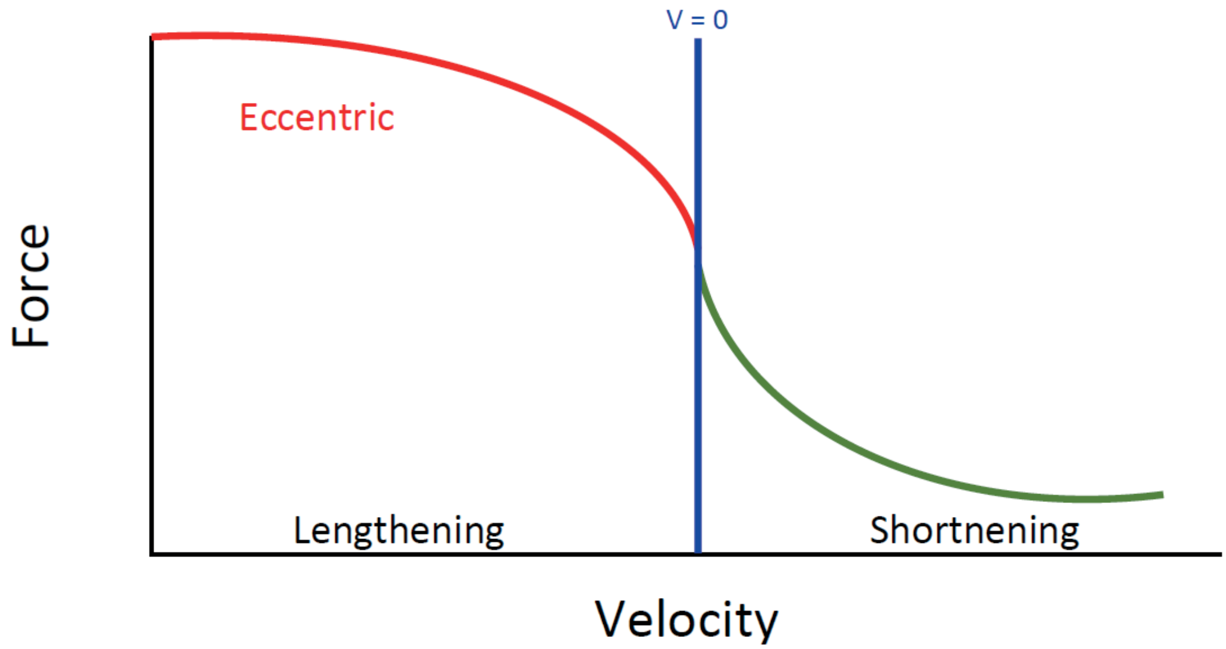

Figure 3.14 - The Force-Velocity Curve of a Muscle through All Three Muscle Action Phases

Figure 3.14 represents another crucial reason the three muscle action phases must be trained on an individual basis. As the eccentric and isometric phases are able to produce significantly greater levels of force, they must be trained with extremely high loads to achieve the greatest stress, and thus, adaptation (67).

The most effective method to applying stress and improving the eccentric phase of movement is through the completion of a slow, muscle-lengthening movement at a high-load. The training of this muscle action fits both the Modified Undulated and High-Quality Training Models as times of either seven or ten seconds are utilized for eccentric training. This extended time under tension allows both the muscle spindles and GTOs to adapt to the highest level, as they experienced increased stress. As fewer muscles are recruited in eccentric movements, these recruited muscles also experience greater stress, leading to increased adaptations realized within the muscles themselves. This is especially important as it is the explosive, type II fibers that are recruited first in the eccentric phase (68,69).

It is important to note eccentric training, due to its nature and implementation, is both extremely taxing and damaging. The fatigue is experienced by the CNS to a great extent as high-loads with increased time under tension are experienced, while muscle damage is also induced. For this reason, eccentric training methods are only implemented at specific times of the annual training cycle. However, each of these stressors, when applied appropriately as laid out in this manual, will maximize an athlete's ability to absorb high levels of force in an extremely brief time period. This ability to absorb force rapidly is a critical skill in the fast-paced game of lacrosse, which requires constant deceleration and re-acceleration.

3.52 Isometric Muscle Action Training

Following the pattern of the SSC, the isometric training phase is implemented after the eccentric muscle action has been specifically improved. This second training phase is designed to continue the optimization of both power and efficiency of the SSC in lacrosse specific movements. As stated previously, the isometric phase functions as the transfer of force between the eccentric and concentric muscle actions (64). Due to the brief nature of its occurrence in dynamic movement it is the most commonly overlooked muscle action, yet its role in efficient transfer of high-forces cannot be overstated. When this phase is not trained specifically, an athlete will “bleed” potential free energy at this weak link during SSC utilization, leading to inefficient movement and reduced power production.

The isometric phase, when implemented appropriately, causes an adaptation in two nervous system processes. These two include muscle recruitment and rate coding (64). The importance of both of these are demonstrated in the RFD portion of this section. However, as a brief reminder, muscle recruitment refers to the number of muscle fibers in an activated state. This also returns to the size principle introduced above in the eccentric section. Rate coding is the rate at which the activated fibers fire. As rate coding increases, tension is increased in the muscle, leading to increased force production. Through specific training, the nervous system can be adapted to increase the frequency of rate coding. An explosive athlete must be able to both activate his explosive muscle fibers, while also increasing his rate coding to the highest extent (64). Clearly these are important as they play critical roles in an athlete’s RFD capabilities.

Although the isometric muscle action is weaker than the eccentric phase, it is still able to produce higher force levels than the concentric phase. This is demonstrated in Figure 3.14. The most effective method to improve the isometric muscle action phase, like the eccentric phase, is to complete movements specifically with holds. To complete an isometric exercise, an athlete will hold the load at a specified position, typically a mid-range or disadvantageous position. For the greatest improvements to be realized, an athlete must focus on pulling themselves into the position at a high-rate and then immediately stopping the load. This leads to maximal recruitment and rate coding (64).

All performance coaches must understand that improvements in isometric strength only transfer about ten degrees in either direction from the position trained (64). In other words, if an athlete trains an isometric squat position at 45°, transfer of this improvement is only experienced between the knee angles of 35 and 55°. That being said, if the majority of competition movements are outside of this range, the athlete will not be capable of implementing this specific strength in the action being completed (64). For this reason it is imperative coaches understand the specific joint angles at which movements are executed on the lacrosse field in order for optimal transfer of training and utilization of the SSC to occur.

Through increased time under tension and high-quality training, isometric training is implemented to increase motor unit recruitment at high loads as well as rate coding, which are both important for improving the RFD of an athlete. The improvement of the isometric phase will enhance the capability of the muscles and tendons utilized to transfer higher levels of force throughout the entire kinetic chain. The eccentric phase was improved specifically to allow the safe absorption of increased levels of force throughout the body. This increased force absorption allows the SSC to experience a greater “stretch,” and thus, increased stored energy. The isometric phase is then trained to the highest level to allow this increase in stored energy to be transferred into the concentric phase of movement. If the isometric phase is not trained appropriately, the body will be unable to transfer force appropriately. This lack of efficient force transfer is clearly visible to every coach with an athlete that gets “stuck in mud.”

3.53 Concentric Muscle Action Training

Only when both the eccentric and isometric phases have been improved individually can the concentric muscle action phase be enhanced to the fullest extent. This power-producing muscle action is viewed as the “sexy phase” of the three muscle actions. This phase is the measuring stick utilized to evaluate nearly every movement in athletic performance. Whether the test completed is lifting a weight, jumping, or running, the measurements being considered are based on force production through the concentric phase. It is from this phase of movement that RFD is calculated.

For this reason, many performance coaches place a primary emphasis on this one movement. However, this leads to an inefficient functioning of the other two muscle action phases. The importance of each phase in regards to lacrosse performance should be well understood at this point.

As stated previously, the concentric phase is defined as a muscle producing a level of force to overcome the load placed upon it. The ability to produce the highest levels of force in the concentric phase is dependent on the SSC and the athlete’s ability to absorb and transfer forces in an eccentric and isometric fashion, respectively. When the role this final muscle action phase plays is considered with the previous two phases, it is becomes clear why the concentric phase is also imperative for maximizing explosive strength. An athlete who can quickly build and absorb energy is nothing if that energy cannot be used to concentrically rapidly produce force.

When training the concentric phase of movement, it is important for coaches to think in terms of whole neuromuscular systems. The true importance of training the concentric phase is the synchronization of the entire triphasic muscle action – maximizing the energy transfer from the preceding eccentric and isometric phases into a unified, explosive, dynamic movement. For this reason, the concentric phase trains two categories of muscular coordination: intramuscular coordination and intermuscular coordination [(64)].

Intramuscular coordination is the coordination of fibers within the same muscle group [(64)]. This takes into account the same neurological process as previously discussed in the isometric phase, motor unit recruitment and rate coding. Intermuscular coordination, on the other hand, is the coordination between different muscle groups, or the synchronization of the entire kinetic chain [(64)].

This takes into account inhibition/disinhibition and synchronization between muscle groups. Inhibition/disinhibition refers to the role that agonist and antagonist, or inhibitor and disinhibitor, muscles play in every muscular action. Every time a muscular contraction takes place, there is an agonist muscle concentrically contracting to produce force and an antagonist muscle eccentrically contracting to try to decelerate the speed and force of the concentric contraction to protect the joint. By training the concentric phase at high forces, an athlete creates a smaller inhibition of the antagonist muscle. Similar to the principles discussed during the eccentric phase regarding the muscle spindle and GTO, by training the inhibition of the antagonist muscle an athlete will be able to improve his intermuscular coordination, resulting in maximal RFD. However, these adaptations are not possible to the fullest extent without first training the eccentric and isometric phases. The concept and literature backing the agonist/antagonist training adaptation can be viewed here.

Clearly there is more to training the concentric phase than just improving the contractile mechanism. An athlete who can generate more explosive force in less time, or increase his RFD, will only have a decisive advantage over his competition if he can unleash that power in a manner that gives him a performance edge.

The concentric phase of dynamic movement is a much more complicated motor task than the eccentric or isometric phases. The concentric phase, just like all other acts completed within the body, is a learned, trainable skill. For an athlete to develop maximal RFD, he must be able to efficiently and rapidly perform a concentric contraction through the use of his stretch-reflex and SSC.

The synchronized ability of an athlete to utilize his stretch-reflex and SSC throughout a dynamic movement has been termed "reactive ability." The synchronization and efficiency, or lack thereof, of these processes will ultimately lead to an optimal or suboptimal RFD by an athlete. For this reason, the concentric phase cannot be taken for granted, as it is the final phase completed in all movements on the lacrosse field. An athlete can spend weeks learning how to eccentrically and isometrically absorb energy, but if he fails to teach his body how to unleash that power, it is all for nothing.

The most effective means for training concentrically is fairly straightforward and simple – train fast! The goal of concentric training is to maximize intermuscular coordination, increase motor unit recruitment, and maximize force production. Concentric means will look very familiar to most strength coaches and trainers because they are the predominant form of stress used in training. However, after previously building a solid foundation of eccentric and isometric strength using triphasic means, an athlete will be able to move loads at much higher velocities. The most important thing to remember when performing dynamic, concentric focused work is to push against the bar as hard as possible, driving the bar all the way through its entire range of motion. The focus should be on developing a synchronized, powerful concentric contraction.

With the agonist/antagonist training adaptations being a primary goal within this training phase, The Triphasic Lacrosse Training Model also implements oscillatory (OC) movements throughout the annual program. This method is implemented throughout multiple training blocks and serves a specific purpose in the continued improvement of RFD. OC training methods involve a rapid "push-pull" motion in an attempt to maximize the ability of an athlete to reverse the muscle action phase at a high-velocity.

To the untrained eye, these brief, 3-4 inch movements applied with well-trained athletes, can appear as gimmicky and useless. This could not be further from the truth. In reality, the OC methods implemented improve strength within specific movement ranges, continue to increase motor learning of skills, and lead to further adaptations in the three muscle actions required in all dynamic movements.

It is shown in Russian literature that the separation between a level four, or advanced athlete, and a level five, or truly elite athlete, is not the ability to contract their muscles at a high rate, although this is a requirement of both levels, but rather the ability relax their antagonist muscles at a high-velocity. Consider level four to represent an average NBA athlete, highly skilled in his sport, while level five represents a Michael Jordan-caliber athlete. In the five level system, the major difference between these athletes is the ability to relax the antagonist muscles during a rapid movement. This ability to contract and then relax muscles at the highest speeds represents the skill of rapid change of direction in the muscle required in all dynamic movements.

The OC training method is implemented with these specific adaptation goals throughout each of the training blocks shown in Figure 3.15 and 3.16, as well as in-season for RFD maintenance. It should be noted OC methods are also implemented in the glycolytic training block. However, the goal adaptation in this phase is the accumulation of metabolites rather than the improvements described in this section.

Through the individual training of these three phases the athlete will have the ability to absorb, transfer, and produce higher levels of force throughout his entire body. This training enhances the kinetic chain to ensure there is no “weak link” and allows force to be transferred throughout the entire SSC, or “rubber-band,” of the athlete’s body, ultimately allowing maximal force production while also completing movements with the highest efficiencies possible.

3.6 Application Within the Triphasic Lacrosse Training Model

The 3- and 5-Day training programs shown below in Figures 3.15 and 3.16, respectively, represent the application of each of the training models presented above in the Triphasic Lacrosse Training Model. The Block Training Model is applied through the accumulation, transmutation, and realization training phases, which all lead to specific adaptations within the six physical performance qualities, ultimately leading to the maximization of RFD. The Modified Undulated Training Model is utilized as intensity and volume are specifically programmed within each day according to their layouts described above. The High-Quality Training Model is implemented through the timing of sets. This method allows the highest quality to be maintained, as this is a primary goal of these high-intensity training phases. Finally, the implementation of muscle action specific training is utilized in the strength training blocks. By training all athletes to absorb and re-direct high levels of force their injury likelihoods are decreased while their performances are drastically improved. Clearly each of these four training models play a critical role in the improvement of the physical capabilities of a lacrosse player. When even one of these is not implemented in training, optimal performance will never truly be achieved by an athlete.

TRIPHASIC LACROSSE TRAINING MODEL

3-DAY TRAINING MODEL

ACCUMULATION

ECCENTRIC TRAINING BLOCK		
DAY 1 - TOTAL	DAY 2 - TOTAL	DAY 3 - TOTAL
MUSCLE ACTION COMPLETED	MUSCLE ACTION COMPLETED	MUSCLE ACTION COMPLETED
ECCENTRIC TRAINING	REACTIVE/OC TRAINING	ECCENTRIC TRAINING
PERCENTAGE IMPLEMENTED	PERCENTAGE IMPLEMENTED	PERCENTAGE IMPLEMENTED
82.5-87.5%	85-90%	80-85%
TIME OF SETS	TIME OF SETS	TIME OF SETS
7 SECONDS	5 SECONDS	10 SECONDS

ISOMETRIC TRAINING BLOCK		
DAY 1 - TOTAL	DAY 2 - TOTAL	DAY 3 - TOTAL
MUSCLE ACTION COMPLETED	MUSCLE ACTION COMPLETED	MUSCLE ACTION COMPLETED
ISOMETRIC TRAINING	REACTIVE/OC TRAINING	ISOMETRIC TRAINING
PERCENTAGE IMPLEMENTED	PERCENTAGE IMPLEMENTED	PERCENTAGE IMPLEMENTED
82.5-87.5%	85-90%	80-85%
TIME OF SETS	TIME OF SETS	TIME OF SETS
7 SECONDS	5 SECONDS	10 SECONDS

REACTIVE TRAINING BLOCK		
DAY 1 - TOTAL	DAY 2 - TOTAL	DAY 3 - TOTAL
MUSCLE ACTION COMPLETED	MUSCLE ACTION COMPLETED	MUSCLE ACTION COMPLETED
REACTIVE TRAINING	REACTIVE/OC TRAINING	REACTIVE TRAINING
PERCENTAGE IMPLEMENTED	PERCENTAGE IMPLEMENTED	PERCENTAGE IMPLEMENTED
82.5-87.5%	85-90%	80-85%
TIME OF SETS	TIME OF SETS	TIME OF SETS
7 SECONDS	5 SECONDS	10 SECONDS

TRANSMUTATION

REPEAT-POWER TRAINING BLOCK		
DAY 1 - TOTAL	DAY 2 - TOTAL	DAY 3 - TOTAL
MUSCLE ACTION COMPLETED	MUSCLE ACTION COMPLETED	MUSCLE ACTION COMPLETED
REACTIVE/AFSM TRAINING	REACTIVE/OC TRAINING	REACTIVE/AFSM TRAINING
PERCENTAGE IMPLEMENTED	PERCENTAGE IMPLEMENTED	PERCENTAGE IMPLEMENTED
65-70%	75-80%	55-60%
TIME OF SETS	TIME OF SETS	TIME OF SETS
7 SECONDS	5 SECONDS	10 SECONDS

REALIZATION

SPEED TRAINING BLOCK		
DAY 1 - TOTAL	DAY 2 - TOTAL	DAY 3 - TOTAL
MUSCLE ACTION COMPLETED	MUSCLE ACTION COMPLETED	MUSCLE ACTION COMPLETED
REACTIVE/AFSM TRAINING	REACTIVE/OC TRAINING	REACTIVE/AFSM TRAINING
PERCENTAGE IMPLEMENTED	PERCENTAGE IMPLEMENTED	PERCENTAGE IMPLEMENTED
35-40%	45-55%	25-30%
TIME OF SETS	TIME OF SETS	TIME OF SETS
7 SECONDS	5 SECONDS	10 SECONDS

Figure 3.15 - The 3-Day Training Model Implemented in the Triphasic Lacrosse Training Model

TRIPHASIC LACROSSE TRAINING MODEL

5-DAY TRAINING MODEL

			DAY 1 - LOWER	DAY 2 - UPPER	DAY 3 - LOWER	DAY 4 - UPPER	DAY 5 - TOTAL
ACCUMULATION	ECCENTRIC TRAINING BLOCK	MUSCLE ACTION COMPLETED	ECCENTRIC TRAINING	ECCENTRIC TRAINING	REACTIVE/OC TRAINING	REACTIVE/OC TRAINING	ECCENTRIC TRAINING
		PERCENTAGE IMPLEMENTED	82.5-87.5%	82.5-87.5%	85-90%	85-90%	80-85%
		TIME OF SETS	7 SECONDS	7 SECONDS	5 SECONDS	5 SECONDS	10 SECONDS
	ISOMETRIC TRAINING BLOCK	MUSCLE ACTION COMPLETED	ISOMETRIC TRAINING	ISOMETRIC TRAINING	REACTIVE/OC TRAINING	REACTIVE/OC TRAINING	ISOMETRIC TRAINING
		PERCENTAGE IMPLEMENTED	82.5-87.5%	82.5-87.5%	85-90%	85-90%	80-85%
		TIME OF SETS	7 SECONDS	7 SECONDS	5 SECONDS	5 SECONDS	10 SECONDS
	REACTIVE TRAINING BLOCK	MUSCLE ACTION COMPLETED	REACTIVE TRAINING	REACTIVE TRAINING	REACTIVE/OC TRAINING	REACTIVE/OC TRAINING	REACTIVE TRAINING
		PERCENTAGE IMPLEMENTED	82.5-87.5%	82.5-87.5%	85-90%	85-90%	80-85%
		TIME OF SETS	7 SECONDS	7 SECONDS	5 SECONDS	5 SECONDS	10 SECONDS
TRANSMUTATION	REPEAT-POWER TRAINING BLOCK	MUSCLE ACTION COMPLETED	REACTIVE/AFSM TRAINING	REACTIVE/AFSM TRAINING	REACTIVE/OC TRAINING	REACTIVE/OC TRAINING	REACTIVE/AFSM TRAINING
		PERCENTAGE IMPLEMENTED	65-70%	65-70%	75-80%	75-80%	55-60%
		TIME OF SETS	7 SECONDS	7 SECONDS	5 SECONDS	5 SECONDS	10 SECONDS
REALIZATION	SPEED TRAINING BLOCK	MUSCLE ACTION COMPLETED	REACTIVE/AFSM TRAINING	REACTIVE/AFSM TRAINING	REACTIVE/OC TRAINING	REACTIVE/OC TRAINING	REACTIVE/AFSM TRAINING
		PERCENTAGE IMPLEMENTED	35-40%	35-40%	45-55%	45-55%	25-30%
		TIME OF SETS	7 SECONDS	7 SECONDS	5 SECONDS	5 SECONDS	10 SECONDS

Figure 3.16 - The 3-Day Training Model Implemented in the Triphasic Lacrosse Training Model

3.7 Adaptations Realized Due to the Triphasic Lacrosse Training Model

When each of the four training models described above are implemented into a system, such as the Triphasic Lacrosse Training Model, the adaptations and results speak for themselves. Below is a vertical jump completed on a force plate for a single athlete as he progresses through the training model presented in this manual. In Figures 3.17-3.19 below the phases of training and the adaptations they create become clearly visible. Each of these adaptations will be described throughout the remainder of this section.

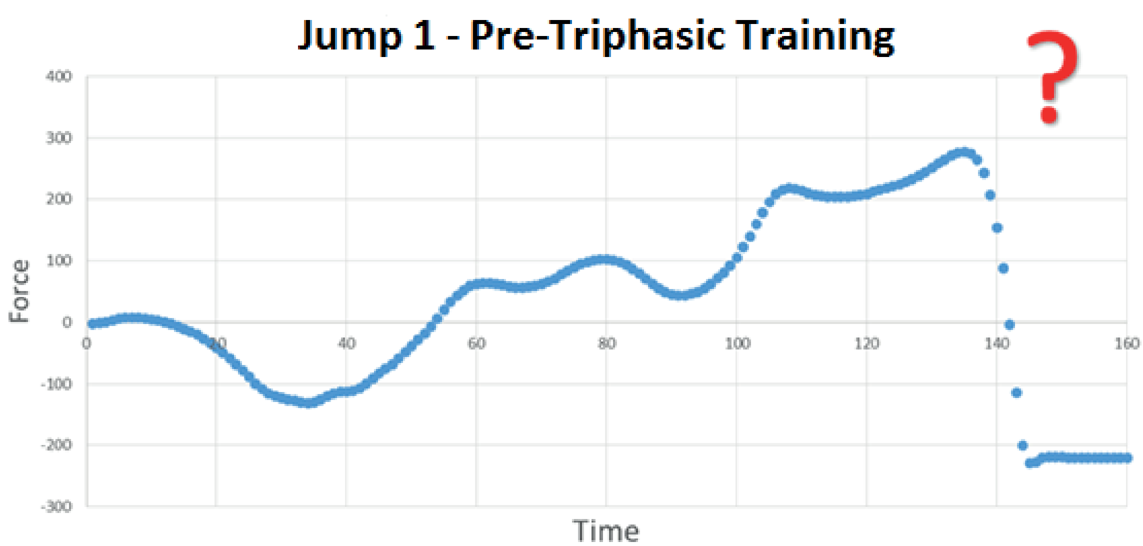

Figure 3.17 - Pre-Triphasic Training

Figure 3.17 above depicts the athlete's RFD pre-training. Based on the amount of force produced, as well as the time it takes for the athlete to produce it, this athlete would be considered extremely weak and slow. The "?" represents the fact that this athlete never produces 300 lbs. of force during a single impulse. Any explosive athlete will generate much higher levels of force than this. Ultimately, this athlete requires training in multiple physical performance qualities.

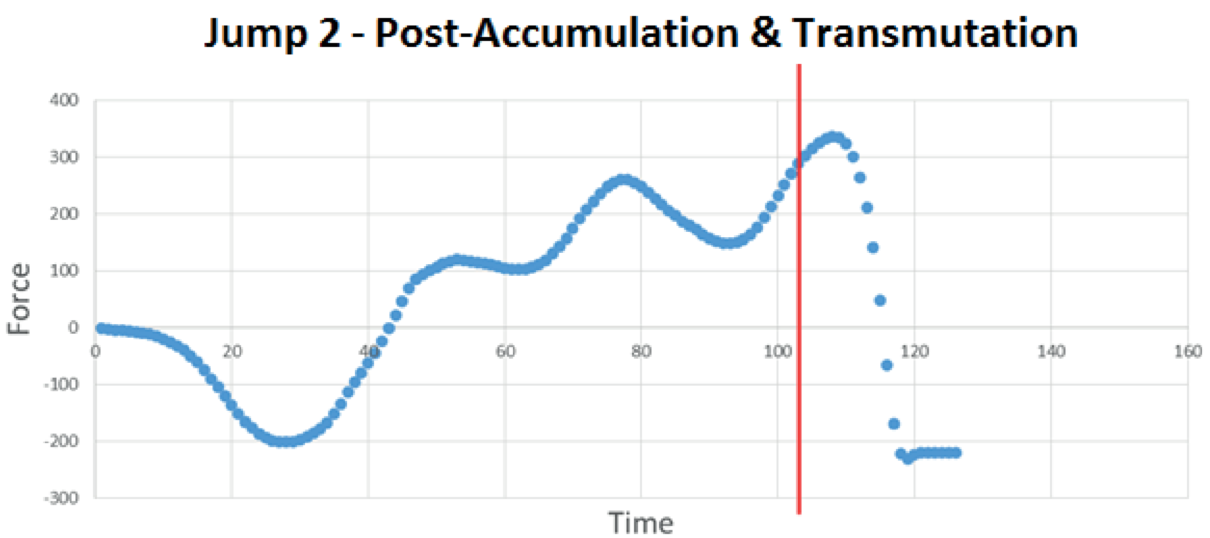

Figure 3.18 - Post-Accumulation and Transmutation Training (12 Total Weeks, 9 High-Intensity & 3 Downloads)

Figure 3.18 above demonstrates an athlete that has completed the accumulation and transmutation phases of training, meaning the muscle action phases described above, along with the Repeat-Power Training Block have been implemented for this athlete. There are noticeable differences in this athlete now compared to just twelve weeks before (Figure 3.17). First of all, this athlete now achieves the 300 lbs. of force through a single impulse while jumping. This is a critical adaptation, as strength lays the foundation for all other force-producing physical performance qualities. Secondly, and more commonly missed, there is a significant adaptation to the athlete's jump in the early stages. This early phase represents the eccentric and isometric phases of the athlete jumping, as he must lower himself prior to completing the jump. The athlete now reaches the -200 lbs. of force in a single impulse during the jump in Figure 3.18. In his first jump, Figure 3.17, he only reaches about -120 lbs. of force. This decrease in force represents an active "pulling" of the jumping athlete. This athlete has learned to utilize his SSC to a higher extent and can now absorb and then re-apply much higher levels of force. He has created the "V" of an elite athlete, one who can absorb, transfer, and re-apply the highest levels of force. This skill not only improves power production but also movement efficiency. Although these adaptations are excellent and exactly what every athlete's goal should be for these phases, there is one issue. This athlete still takes about 1.05 seconds to achieve his 300 lbs. of force threshold. Ultimately, this athlete would be considered strong but slow. He has made considerable improvements to his force production, but he must continue to improve his early phase of RFD to maximize performance on the lacrosse field.

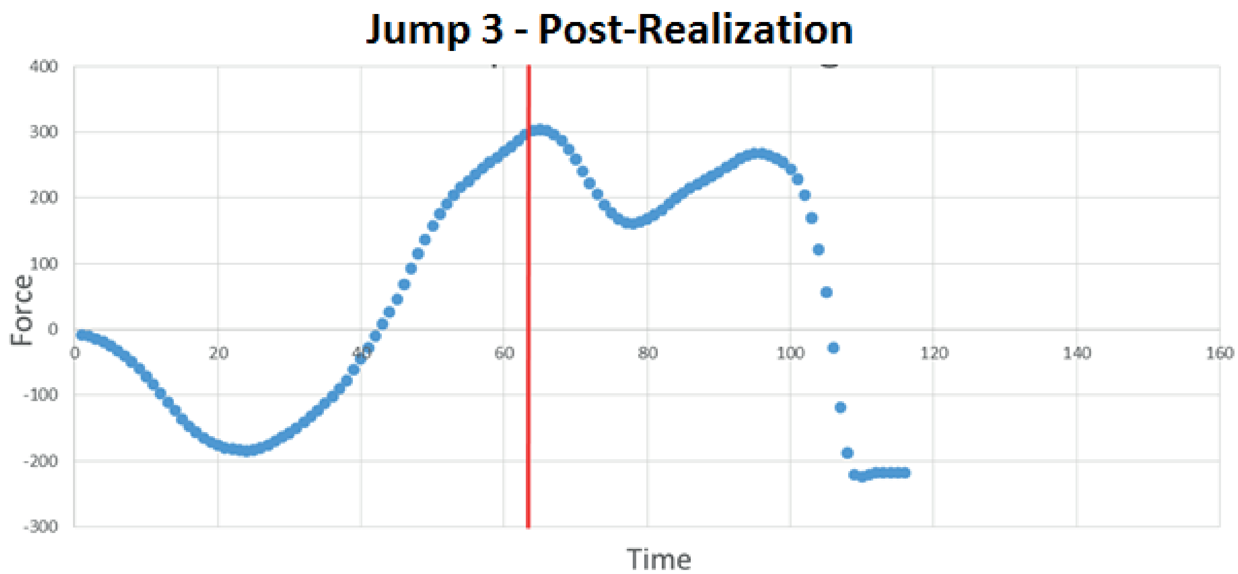

Figure 3.19 - Post-Realization Training (3 Total Weeks, 3 High-Velocity & 1 Download)

Finally, Figure 3.19 above represents the adaptations experienced in the realization training phase, or the speed training block. This jump was executed a mere four weeks after jump two shown in Figure 3.18. By training with high velocities and low loads, this athlete has increased his neural drive, which is critical for the early phase of RFD. The jumping athlete still produces high levels of force, as 300 lbs. of force is achieved in a single impulse; however, this athlete is now producing that force level in 0.65 seconds. Just four weeks before this test that feat required 1.05 seconds, almost double the amount of time. The athlete that has progressed through each of the phases of the Triphasic Lacrosse Training Model is now not only strong but also fast. Optimal athletic performance on the lacrosse field is now possible with the addition of appropriate on-field skills due to his physical preparation.