Strength Training Considerations for the Bicycle Motocross Athlete

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SUMMARY


The sport of Bicycle Motocross (BMX), despite being close to 40 years old, was relatively obscure to the public until its inclusion in the 2008 Olympics, and as such, it had received very little attention from the scientific community. For the strength and conditioning coach, the paucity of literature around the sport provides little assistance for programming guidance. The majority of the research on the sport is in reference to injury with modest consideration to performance (3,7,18). Of the small number of publications that do pertain to performance, the importance of rider technique and the power output are consistent themes (14,27,33). The current article aims to present a potential specific exercise selection designed to enhance BMX performance.

BMX is a mass-start bicycle race lasting 35–45 seconds where a maximum of 8 riders contest a 300-m to 400-m track. Figure 1 (http://www.chulavistasupercross.com/facts_track.htm) illustrates an example of a BMX Supercross track. All the riders use the same start ramp and first straightaway. Coming out of the first corner, the track splits where the elite men take one path and the elite women and junior elite riders take the other. The track remains separated until the end of the third straightaway where the 2 tracks are combined once again. Our observations indicate that the first straightaway is where the riders are doing most of the pedaling and establishing track position (of the 9 seconds approximately, ~45% of the time is spent pedaling). The second straightaway has much less pedaling than the one prior; however, the jumps are much larger with the riders spending considerably more time in the air and transitioning between jumps. The third straightaway is often called the “Rhythm Section,” and it is characterized by the rider navigating a series of smaller jumps in quick succession. The rider typically pedals and jumps very little on this straightaway and instead “pumps” or uses his or her own bodyweight to generate speed and momentum. The fourth and final straightaway is typically very similar to the third, although often much shorter in length.

As can be observed in Figure 2, at the start, the riders are in close proximity to one another and the staging area is on a decline, allowing the riders to maintain a standing position with the feet clipped into their pedals by “propping” themselves against the hydraulic start gate. The announcer’s cadence prepares the riders to watch the staging lights, which are accompanied by a series of beeps signaling the drop of the gate. The race commences with the drop of the start gate, and the riders attempt to gain speed as quickly as possible in an attempt to gain best track position against their opponents. Because of the technical demands of the sport, the rider who is in front is at a distinct advantage because he or she is best able to dictate the ideal navigation of the obstacles (33). Unlike other cycling disciplines lasting a similar...
duration, BMX is contested entirely from a standing position, it is aided by gravity, and the effort is not continuous (4). Because of these fundamental differences, much of the research supporting best practice for seemingly similar cycling events is not necessarily specific to BMX (23). In addition to the intermittent nature of BMX, the riders also have to contend with large jumps, banked turns, smaller jumps in quick succession, and as many as 7 other riders who may be vying for the same race line through one of the aforementioned obstacles.

The power output needed to be successful in BMX is somewhat of an unknown quantity. Some research
suggests that peak power output of professional BMX racers is approximately 1,000 watts, whereas more recent data have recorded values closer to 2,000 watts (2,27). Although the measuring device of the former data is not known, the latter data were recorded by an SRM power meter (Schroeder Rad Messtechnik, Jülich, Germany), a device with proven validity (8,11). This is consistent with the anecdotal reports of the highest power output ever recorded (2,500 watts) on a bicycle being performed by a 90 kg former BMX racer. Although research has not shown peak power output to be a defining factor for successful BMX performance, it is a factor that should be taken into consideration in terms of exercise selection and acute exercise variables, such as load and speed of movement specificity.

There are multiple components for a BMX race: the start, pedaling, jumping, and “pumping.” “Pumping” is the action the rider takes in sections where he or she is neither pedaling nor jumping and the goal is to generate as much speed as possible through the efficient use of bodyweight while overcoming the obstacles. The start is often considered the most crucial component of a BMX race (33). As demonstrated in Figure 3, the predominant movement pattern is hip extension. When jumping and pumping, the riders’ movement is mostly concentrated in the torso with particular specificity to horizontal shoulder abduction and adduction (Figure 4). Generation of force while pedaling is predominantly a by-product of hip and knee extension (9).

EXERCISE SELECTION

Considering the different skills associated with BMX racing, there are several exercises that are thought to influence performance in these areas. The selection of exercises described below are thought somewhat specific to the strength, power, and technical demands of the sport. Specific attention should be paid to flexion/extension of the hip and knee and to horizontal shoulder abduction/adduction (6).

To address the strength and power required for the acceleration demands of a successful start, the power snatch from the hang position is thought to be a useful training exercise. Successful performance of this lift requires strength, power, high rates of force development (RFD), and tremendous technique, as in the start (17,33). Furthermore, one of the few tests that has been positively correlated to BMX performance is the vertical jump test (r = −0.781), and research has shown that athletes who improved performance in the snatch also improved jump height in the vertical jump test (15,21,30). To enhance this specificity, it is suggested to perform this exercise from the “hang” position (Figure 5). In this variation of the lift, the athlete initiates the lift while holding the bar at hip height. A quick dip of the bar by means of hip flexion initiates the exercise and mimics the recoil movement seen at the start of a BMX race where the bicycle, before making forward progress, makes a slight backward movement or countermovement. It is also suggested (if the mobility of the athlete allows) to narrow the grip on the bar slightly to further emphasize power development by increasing the range of motion. Although the athlete may not be able to lift as much weight with a narrower grip because of the increased bar traveling distance, this should not be a concern because the amount of power output needed to gain momentum during a BMX start is considerably less than is typically seen in a snatch lift (approximately 25 vs. approximately 40 watts/kg) (2,12,13). Because the power snatch is a technically difficult movement, some coaches may opt to use the power clean from the hang position or the mid-thigh pull. Coaches may find these lifts useful for a variety of stimulus or because of an athlete’s limited range of motion, and studies have shown both to be valuable tools for increasing RFD (16,19).

Jumping and bounding exercises are other exercises that can be used to improve RFD. The almost purely concentric nature of force development in cycling is somewhat unique in sport. As such, the need to develop RFD as it pertains to the stretch-shortening cycle is diminished. In practical terms, a speed-strength protocol that de-emphasizes eccentric muscle actions and emphasizes concentric RFD is intuitively logical (logical validity). Examples of exercises of this type are concentric-only, single and double leg hops (Figure 6) onto a box, and running up stairs while attempting to keep foot-ground contact time to a minimum and leg turnover rate (cadence) at a maximum.

The deadlift is an exercise that can address many of the needs of the BMX athlete. Unlike the power snatch, which must be performed explosively, the deadlift can either be performed explosively or with maximal force, or

Figure 3. (a) BMX racer staged to start. (b) BMX racer initiated in start.
anywhere in between in the load spectrum. The involvement of hip and knee extension as well as the bar having to be grasped in the hands makes it an ideal choice for the BMX athlete. As a BMX rider progresses through a track, different parts of the race may benefit from different aspects of the adaptations created from deadlift training. For example, grip and isometric strength during landing and dynamic hip and knee extensor strength in the rhythm section may benefit from adaptational transference from the deadlift.

Video analysis has shown that the arms abduct and adduct to the torso in the horizontal plane during many situations while a rider is negotiating a BMX track. Essentially, any time a rider is moving over an obstacle, regardless of size, some form of this movement pattern occurs. To best condition this arm movement, the ideal exercise would be the bench press, and more specifically, a bench press with hand spacing that approximates that which is used when grasping the handlebars (Figure 7). The bench press movement has been used to benefit performance in many sports (1,29). There are many ways to vary the exercise to improve specificity, such as adjusting the incline of the bench, using novel bars, modifying hand spacing, or implementing dumbbells or a pulley system as resistance. All these have the potential to benefit BMX performance.

The pull-up and rowing exercises are proposed as exercises for improving specific pulling strength in the BMX athlete. Like the bench press, pull-ups and rows have been used in many strength and conditioning programs for various sports (13,22,23,25,31). Although some may consider a lat pull-down a viable alternative to the pull-up, our suggestion is that this would decrease the specificity of the exercise. In BMX, the ability to control one’s body is a foundational skill for optimal technique. The pull-up is an excellent demonstration of relative strength (strength in relation to body mass). Furthermore, because only the hands are in contact with the immovable object, increased stability is required as the body moves around the object. In a lat pull-down, the legs are in a fixed position, requiring little or no trunk stability and relatively little dynamic joint stability of the shoulder (25). It is also recommended to vary hand width and grip style to create a variety of stimulus for the pull-up. When observing BMX athletes’ upper-body pulling movement patterns, barbell, pulley, and dumbbell rows with horizontally adducted and abducted shoulders emerge as exercises with obvious carryover. These exercises may also be manipulated to increase specificity by implementing a variety of grip (pronated, supinated, and neutral) styles and widths for diversity and specific adaptation.
PROGRAMMING AND PERIODIZATION

A Union Cycliste Internationale World Cup season of BMX racing is effectively a year long, commencing in August and ending in July with the World Championships (www.uci.ch). Pinnacle events, such as the Supercross events, are much less frequent and run from October to July. Athletes considering competing at the highest level should prioritize the highest ranked events, such as the Supercross events, when creating an annual training periodization plan.

A properly designed undulating training plan will incorporate exercise selection, training intensity, training frequency, training volume, and rest (20,24). In theory, this plan should target peak performance at specific event(s), and one way to do this is to choose the target event(s) and work backward, developing the necessary training adaptations in a systematic manner so that all will culminate in peak performance at the appropriate time. For a BMX athlete looking to compete at the highest level on the Supercross tracks, there is an additional challenge because of the irregularity of the schedule. For the 2010–2011 season, these events occurred and will (tentatively) occur in October, early April, late May, late July, mid August, and mid and late September in various locations throughout the world; the sporadic event scheduling should allow for an increased preparation for some events while not for others. This needs to be taken into consideration when planning the training program.

If the training season is divided into microcycles lasting 1–6 weeks, the cycles should build in intensity according to event schedule and training adaptations desired. In the annual plan detailed in the Table, the training phases are longer in duration during the initial preparation period and shorter as the rider’s transition into the competitive season. The General Physical Preparation (GPP) phase is characterized as one that emphasizes an increase in work capacity. From GPP, the riders will focus on hypertrophy. Increased size serves to the benefit of the rider by not only improving his or her physical “presence” on the track but also reducing likelihood of injury from crashing (10). Hypertrophy can also be
an important antecedent in increasing force production capacity (34). Because a rider’s RFD is expressed relative to the bodyweight, the amount of emphasis on hypertrophy should be reflective of this. For the BMX athlete, force production should be expressed in relative versus absolute terms. Because the athlete is self-propelled and overcoming or managing inertial forces, gaining excessive body mass should be discouraged. Force production is a key component in the power equation, and the ability of the athlete to express high levels of relative force will allow him or her to increase in the ability to improve power output (5,32). The focus on power is the last phase leading into the competitive period and, along with force production, will be revisited periodically so that the power production capability does not diminish.

When the athlete is a nonprofessional or developing racer, the approach to strength and conditioning, and periodization can be less formal. Because in situ situations where RFD is a predominantly concentric muscle action as in BMX, the most influential factor is strength, and this has been shown to be especially true in less-trained athletes (26,28). This will be a key component for maximal RFD in the start where, because the rider is accelerating from a dead stop, the external loads are the highest. As the rider progresses on the track and momentum is gained, the external loads are diminished and maximal strength would become less influential. To address these needs, high-velocity RFD-focused training where loads are less than 25% 1 repetition maximum, such as box jumps, and explosive pushing and pulling exercises are indicated (26). In conclusion, for the developing athlete, the strength and conditioning program should include a balance of work that emphasizes maximal and explosive strength.

**PRACTICAL APPLICATIONS**

The current selection of exercises and conditioning practice, and the proposed periodization is based on the practical experience and the sparse research that is available. To properly assess the specificity of a given exercise or strength and conditioning program, a detailed time-motion analysis of BMX is necessary. Without specific kinesiological, physiological, and anatomical knowledge regarding the specifics of a BMX event, programming suggestions are largely speculative. Furthermore, each individual BMX athlete will have different needs in terms of how to achieve performance gains through the implementation of a strength and conditioning program. The strength and conditioning coach would be wise to develop a system of testing where the current status of the athlete and the desired training adaptations can be measured. Some riders may need to focus on hypertrophy, whereas others may need to improve strength or power, or perhaps some combination of all 3. With this in mind, it needs to be acknowledged that periodized plans need to be individualized and constant monitoring of the BMX athlete should be ongoing so that the strength and conditioning program is reacting to the needs of the rider.

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<th>Emphasis</th>
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REFERENCES