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Chapter 2

Mental Preparation

Achieving peak athletic performance with consistency requires a combination of sports-specific training, seasonally adjusted physical conditioning, injury prevention or rehabilitation, life balance, and mental preparation (Beswick 2001; Dorfman 2000; Dorfman and Kuehl 1995; Loehr 1994; Loehr and Schwartz 2003; Porter 2003, 2004; Porter and Foster 1990; Rotella 2004; Yandell 1999). The integrated use of basic and complex mental skills that can be learned through repetition produces high achievement in persons with athletic talent regardless of the competitive level or sport. To review, the basic skills are breathing and relaxation, positive self-talk, focus and attention shifting, visualization and imagery, and motivation and persistence; the complex skills are goal setting, self-evaluation, precompetition routine, and emotional control and intensity regulation (McDuff et al. 2005). Each of these mental preparation skills can link to and enhance general fitness, sound nutrition, injury recovery, life balance, and sports-specific training to produce consistent competitive self-confidence (Figure 2–1). When physical and mental training are integrated, the athlete can compete with a quiet mind, relaxed body, raised energy, and narrowed and rapidly shifting attention, producing automatic play that is described as "in the zone." In this chapter, I describe the application of five basic and five complex mental skills to individual sports (golf, tennis, track) and team sports (baseball, softball, football, soccer, ice hockey). Case studies from high school, club, intercollegiate, and professional levels are included. Recent findings from applied neuroscience and functional imaging research are introduced to validate and explain the use of these skills.

Athletes who excel at the highest levels have organized approaches for fitness, injury prevention, practice and competition, and mental prepara-

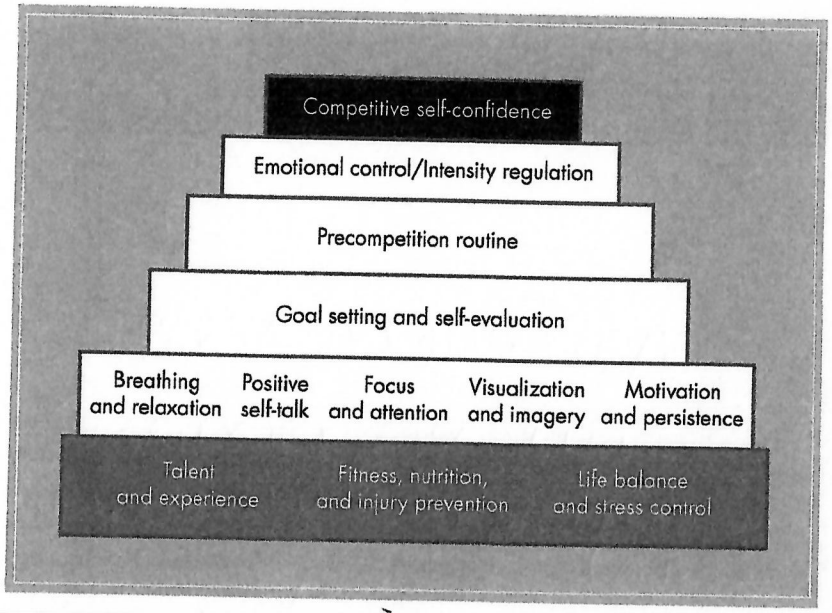

FIGURE 2–1. Pyramid of mental skills linking athletic fundamentals to competitive self-confidence.

tion. Elite players who consistently achieve peak performance despite changing competitive circumstances display quality preparation, competitive follow-through, and accurate self-evaluation. Stated more simply, they are ready to compete, get the job done, and react to results (Maher 2011). They also share a common set of emotional competencies and personality traits.

Emotional competencies are natural or learned skills that enhance an athlete's ability to compete with intensity and consistency and to become a good teammate (Aberman 2011; Anderson and Aberman 1995). The most important of these is *emotional control*—the ability to manage feelings and impulses to act while staying focused on a goal in the face of changing competitive circumstances. This competency permits individuals to play through mistakes and injuries and to bounce back when they are being outplayed. A second important competency is *self-awareness*—the ability to maintain perspective between ideal or unrealistic images of play and actual images that are based on accurate feedback from film or others. This ability prevents the development of unrealistic expectations and ensures that play occurs at the proper competitive level. A third important competency is *internal motivation,* which refers to practice or play that is based on a natural or developed love or passion for the game

rather than an attempt to satisfy the expectations of others or for scholarships, fame, or social popularity. This competency prevents burnout and disappointment with playing time. A fourth competency is *empathy*—an instinctive ability to be sensitive to and supportive of others. This competency is critical to team unity and purpose. The final competency, *socialization,* refers to the ability to be an effective communicator and to bond with others while maintaining an attachment to strong competitive ideals and values. This competency is also necessary for team unity and critical for the development of a distinctive team style of play.

Group studies of Olympic champions have identified nine traits that are associated with high athletic achievement (Porter and Foster 1990). These traits, described in the following list, can be remembered using the acronym BELIEVE IT.

- **B**alances sports and other life areas. This trait refers to the ability to shift time and energy from sports to other important areas, such as family, friends, academics, hobbies, and rest. This ability follows an important principle in athletics, in which stress and recovery are described as making waves (Loehr and Schwartz 2003). Unplugging from training and competition, even if briefly, allows an athlete to return to practice and competition with renewed energy and enthusiasm. For younger athletes, this trait also refers to the ability to play and enjoy other sports or to cross-train.
- **E**ncourages and supports teammates. This trait is most necessary in team sports to ensure uniform intensity, work rate, and playing rhythm. Surprisingly, athletes who encourage competitors in other sports or on other teams seem to benefit from getting outside their own competitive arena.
- **L**ets go of mistakes and defeats easily. This trait is especially important in continuous- or repetitive-play sports, such as soccer, softball, tennis, or golf. If one or more players lose intensity or become distracted after a poor play or defeat, then the entire team's play can drop. Similarly, a bad pitch, an unforced error, or a bad shot can result in a dramatic performance decrement.
- **I**magines self and abilities in positive way. This trait means that despite winning or losing, the athlete maintains positive thoughts and feelings.
- **E**njoys training and competition. This trait means that despite a player's hard work and setbacks, his or her passion for the game and satisfaction from steady improvement dominate any negatives.
- **V**isualizes success and positive play. This trait refers to maintaining a general view that success ultimately comes from quality preparation and using visualization and positive imagery in practice and daily be-

fore competition. These mental repetitions are easy to do when in a relaxed state and provide a nice addition to the physical repetitions necessary to create the muscle memory of automatic play.

- Evaluates performance and outcome. This trait refers to having a system for reviewing each game to identify the positives of play and areas for improvement, which are used to create actions for the next set of practices.
- Intensity is maintained and regulated during practice and competition. *Intensity* is often defined as controlled and focused energy or aggression. Intensity is built slowly during the pregame routine. It requires that each player clear the mind of clutter and distractions, relax the body, and focus and rapidly shift attention while raising energy. Scoring in individual and team sports often occurs when one team's or player's intensity level rises well above that of the other team or player.
- Talks in positive and encouraging ways. An important goal is for teammates (as well as coaches and parents) to respond positively when they catch each other doing something well rather than groaning or shouting when mistakes are made. The best teams push players to peak play and performance through positive team talk. For individual play, a positive phrase can lock in an action and ensure that it is executed with skill and precision.

Since the late 1990s, evidence-based techniques derived from the cognitive, exercise, and neurological sciences have been introduced to bring a more valid and reliable approach to performance improvement training in sports (Carlstedt 2007; Yandell 1999; Zetou et al. 2002). These neuropsychophysiological approaches include cognitive profiling or brain typing, brain wave and heart rate variability biofeedback, and videotape self-modeling. Cognitive profiling involves testing an athlete before performance using cognitive and neuropsychological measures that assess mind-body interplay relevant to key moments in competition, such as a pass under pressure in soccer or a serve for a set point in tennis. Testing might assess, for example, sustained attention, physiological reactivity, and mistake coping. Biofeedback involves the measurement, feedback, and alteration of physiological parameters such as heart rate variability or brain wave patterns in athletes during a series of interventions over time. These interventions are designed to help a player change a current pattern to one that is more favorable to peak performance, such as decelerating heart rate before a field goal in football or a birdie putt in golf. Videotape self-modeling employs the use of edited video of repetitive, successful demonstrations (staged or actual) of one or more skills that are critical to a specific sport, such as a free-throw in basketball or making solid contact in baseball.

One evidence-based neurophysiological program developed by Carlstedt (2007) advocates a multistep approach. Each step is part of a long-term process designed to help athletes create and maintain a "seamless transition" in competition between the left and right brain hemispheres. In this approach, mental skills training is organized to help athletes improve left hemispheric activation for internal (strategic) planning for a shot or a play before shifting to right hemispheric activation for task or action completion with an external visual-perceptual focus. In addition, the training is designed to prevent the disruptive effects that negative thinking and stress can have on this left-right (internal-external) shift during critical athletic movements. The four steps of Carlstedt's program are summarized as follows:

- Step 1 requires determination of the athlete's personality profile in three areas empirically relevant to peak performance: 1) hypnotic susceptibility/subliminal attention (i.e., effortless attention—"zone trait"); 2) neuroticism/subliminal reactivity (i.e., reactivity to pressure—"zone buster"); and 3) repressive/subliminal coping (i.e., letting go of mistakes—"zone facilitator"). These three traits are strongly associated with the previously mentioned basic skills of relaxation, attention (focus), and self-talk and the complex skills of emotion and intensity regulation and self-evaluation. The ideal profile of *high* effortless attention, *low* reactivity to pressure, and *high* letting go of mistakes is strongly associated with consistent mind-body control and peak performance. In addition, these traits can serve as strong predictors of the mental skills of intervention acceptance, follow-through, and coachability.
- Step 2 involves extensive neurocognitive testing of attention, decision making, impulse control, and brain wave mapping.
- In Step 3, laboratory (timed serial subtractions) and field (repetitive perfect shot making) stress or pressure testing is conducted using heart rate variability measurement.
- Step 4 involves actual in-game monitoring of brain wave and heart rate patterns during critical athletic events using portable monitoring technology.

Basic Mental Skills

Breathing and Relaxation

Athletes, like all people, have two "hard-wired" neurological and neurohormonal systems that operate up and down the mind-brain-body axis.

These opposing stress and relaxation systems activate quickly and automatically during critical movements and can either enhance or degrade athletic performance. The operation and balance of these two systems during practice and competition are vital for coordinated movement and competitive self-confidence. The stress system electrically and hormonally activates the body's cardiovascular, neuromuscular, and visual-perceptual systems, which are critical to athletic movement and intensity. Too much stress activation, however, can lead to excessive physiological arousal, negative thoughts and emotions, and disrupted concentration, which can interfere with the rapid left (internal)–right (external) brain shift that must occur during critical athletic movements.

Stress-related thinking and breathing patterns, facial expressions, and body posture are easy to recognize. Stress breathing tends to be rapid, shallow, and noisy. In addition to use of the diaphragm to move air in and out, stress breathing involves use of accessory facial, neck, throat, and upper chest muscles. The focus of the breath cycle in stress breathing is on inhalation (getting air in). Stress breathing in particular and stress activation in general utilize large amounts of energy that may become unavailable for fitness training, practice, or competition.

Fortunately, the stress system can be opposed by the body's relaxation system. The relaxation system is designed to deactivate thinking, analyzing, and physiological arousal and to trigger calm and relaxation. The drop in cardiovascular intensity and the release of neuromuscular tension allow for a fluid left-right brain shift and technically correct motor actions during critical athletic movements. Relaxation breathing is distinctly different from stress breathing in that the former tends to be slow, quiet, and deep, and it uses mainly the diaphragm to move air. Relaxation breathing emphasizes exhalation and tension release, and exhalation tends to be significantly longer than inhalation. The relaxation system can be activated by many activities, such as meditation, stretching, sunning, exercise, reading, naps, massages, socialization, walks, good nutrition, and specialized breathing techniques.

Three specialized relaxation breathing techniques adapted from Weil (1999) can be easily learned and used to immediately quiet the mind, release tension, and reduce unnecessary emotional intensity. *Patterned relaxation breathing* consists of breathing in through the nose quietly and evenly for 4 counts, holding for 7 counts, and then breathing out through the mouth evenly for 8 counts—this pattern is repeated eight times and takes about 2 minutes. Breathing in through the nose warms, moistens, and filters the air, allowing the lungs to relax and fill completely and evenly. Holding the breath (while counting and/or rocking) allows the mind to quiet and the body to settle. Breathing out allows for

the release of mental and physical tension and strengthens the mind-body connection. In addition, the nose-mouth pathway activates a relaxing electrical circuit that facilitates tension release. A single breath cycle can be strengthened by saying, "in–2, 3, 4; hold–2, 3, 4, 5, 6, 7; out–2, 3, 4, 5, 6, 7–one..." while breathing.

The second technique is controlled *nasal hyperventilation.* This involves breathing rapidly (2–2.5 breath cycles per second with good rhythm) in and out through the nose for either three sets of 15–20 seconds each (with easy nose-mouth breathing in between) or one long cycle of 60 seconds (aiming for about 160–180 breath cycles in 60 seconds). Each episode of hyperventilation is likely to produce some mild symptoms resulting from low carbon dioxide and respiratory alkalosis (e.g., light-headedness, blurred vision, extremity tingling). These symptoms will disappear quickly, however, after two or three clearing breaths (in through the nose for a count of four and out through the mouth for eight counts or more) followed by easy nose-mouth breathing.

The third technique is the *clearing breath.* This involves starting a breath cycle by clearing all the air out through the mouth until a small knot is felt in the midline just above the navel. A smooth inhalation through the nose follows to a count of 4 until the lungs are filled to the level of the collar bone. Finally, a smooth exhalation through the mouth over 8–12 counts clears out substantial tension. The clearing breath is frequently used in competition just before a critical action, such as a penalty kick in soccer, a free throw in basketball, a serve in tennis, or a putt in golf. A triple clear, a variation of the clearing breath, consists of three lengthening breath cycles (in 4–out 4, in 4–out 6, in 4–out 8) and is used to dampen rising physiological arousal or intense worrying.

Case Study: I Get Too Amped Up Before Games

A college defensive back got so "amped up" before games that he could not take in adequate pregame nutrition or regulate his game intensity, which spiraled upward, resulting in multiple late-game penalties and mistakes.

Intervention: He was taught nasal hyperventilation and patterned breathing. Over a few weeks, he discovered that two to three repetitive sets of nasal hyperventilation every few hours starting the day before a game effectively countered his stress response, allowing him to eat and regulate his pregame and late-game intensity.

Case Study: I Feel Much More Pressure at This Level

After moving up to a higher competitive level, a professional baseball player felt anxiety, increased muscle tension, and poor command of his pitches.

Intervention: He was taught patterned breathing and clearing breathing exercises to repeat four to six times per day. In addition, he

started using a clearing breath between pitches while throwing on the side, during warm-up, and in competition. He used a three-step process, in which he would occasionally walk off the mound, face away from the plate, and clear out the tension and focus on his core using a breath in through the nose and a prolonged exhalation out through the mouth. This release of tension allowed him to mechanically get on top of his pitches again and get the ball down in the zone. This improvement was possible because he was relaxed enough to rotate his shoulder, get his arm up, and finish his pitches with good wrist action and feel.

Brain Imaging Research

Meditation is a useful way to promote activation of the body's relaxation system. One of the most basic forms of meditation is concentration meditation, in which sustained attention is focused on an object, such as a small visual stimulus, or the breath. In a functional magnetic resonance imaging (fMRI) study comparing expert meditators to novices, Brefczynski-Lewis et al. (2007) found that activation of brain regions involved in sustained attention was stronger in experts. In addition, when distracter sounds were presented during meditation, expert meditators had less brain activation in regions related to analyzing and emotion, and more activation in regions related to response inhibition. The authors suggested that meditation may improve cognitive processes through negative self-talk inhibition.

Positive Self-Talk

The language areas of the brain have strong neural track connections with important emotional, attentional, and neuromuscular brain areas that are vital to critical athletic movements. According to Rotella (2004), movements in sports are most likely to be graceful and rhythmic if athletes use the unconscious (instinctive, intuitive) mind rather than the conscious (analytical, self-critical) mind. Positive self-talk during practice and competition is a good way to turn on the subconscious mind and get to automatic play. Effective positive self-talk must be simple, trigger a light and easy facial expression, relax and coordinate opposing large muscle groups, and fit within the specific rhythmical pattern of the sport. For example, during a golf swing, a tennis serve, or a baseball pitch, an athlete can say "back and thru" or "up and thru" to turn off analytical, left brain thinking, and to trigger a smooth shift to automatic, right brain action. Choosing short, simple phrases that literally command an athlete to correctly execute a critical movement without excessive thinking or analysis is desirable. In distance running, an athlete can quietly say "rise-up" when running up hills ("rise" is said during exhalation and "up" during shorter inhalation) or "recover-down" ("recover" is said during a long exhalation) on flat sections or

downslopes. Saying "rise-up" with an external focus provides lift and acceleration, whereas saying "recover-down" drops the heart rate, releases muscle tension, and clears out metabolic toxins.

Positive self-talk can also be effective when preparing for an athletic action as part of a broader prepitch (baseball), preshot or prehit (golf, basketball, soccer, softball), or visualization routine (Dorfman 2000; Dorfman and Kuehl 1995). For example, in baseball or softball, a pitcher could occasionally say, between pitches or while visualizing, something like "down in the zone" or a shortened version like "DZ" or "hit my spots." A golfer could say "target line," "back of the cup," or "make it," whereas a tennis player could say "crosscourt," "down the line," or "breathe." When positive self-talk is used as part of a precompetitive or competitive routine, it is even more effective if used along with patterned breathing and visualization. When these different brain areas are activated together, the athlete is literally able to "see, say, and feel" any critical athletic movement, thereby reinforcing its execution.

Case Study: Sometimes I Just Can't Get Negative Thoughts Out of My Head

A professional golfer noted frequent nervousness and negative thinking on the tee box ("don't choke or don't hit the ball right") and competitive self-doubt ("the wheels keep falling off when I make mistakes").

Intervention: He was taught to use the patterned and clearing breathing techniques while holding his driver. At critical times in competition, he learned to walk to the edge of the tee box, face away from the target and his competitor, and take several clearing breaths while gripping the club hard during inhalation and releasing the tension during exhalation. This revised preshot routine helped turn off negative thinking by sending his attention down into his body.

Case Study: I'm Obsessed With Scoring Goals

A high school senior and club soccer player who wanted to play in college was putting too much pressure on herself by repeatedly saying that she needed to score more goals in games. This triggered negative self-talk and self-criticism and generated increased muscle tension, overthinking, and poor touch in competition.

Intervention: Instead of focusing on the desired outcome (goals, assists), she learned to shift her attention to positive play by saying repeatedly to herself "get to the ball," "make runs," or "work rate." By focusing on process rather than outcome, she shifted her talk and emotions from negative to positive and released excessive muscle tension.

Brain Imaging Research

Simple words like "no" and "yes" (and their associated negative and positive commands) are learned in childhood but continue to operate in

adult life. In addition, these words and commands are associated with strong and quick emotionality and variable cognitive and motor response times. In an fMRI study, Alia-Klein et al. (2007) found that the emphatic use of "no" and "yes" vocalizations was associated with opposite brain-behavior response patterns. The "no" vocalization evoked negative emotions and slower response times, whereas the "yes" vocalization produced positive emotions and faster response times. This study supports the idea that positive and negative self-talk and supportive comments by teammates and parents can have quick and opposite influences on emotion, mental processing, and motor reaction times, possibly enhancing or diminishing critical athletic movements. The suggestion by DiCicco et al. (2002) for coaches and parents to "catch them [athletes] being good" may well have an evidence base.

Focus and Attention Shifting

According to sports psychologist Robert Nideffer (1993), playing in the zone and choking are both examples of altered states of consciousness. Altered states of consciousness are characterized by a change in sense of time, perception of the world, or ability to think and remember. For example, time distortion occurs when a person is engrossed in an enjoyable movie and surprised that 2 hours have just passed. This distortion is known as time compression.

The same thing can happen in sports during critical athletic movements. When an athlete is playing well, everything seems more natural; every pass or shot is accurate. When the athlete is not playing well, every pass or shot is off, and the body feels tense or out of balance. Whether the athlete is playing well or poorly, a specific state of consciousness (whether positive or negative) develops during attention shifting. Four distinct attention areas must be understood and mastered:

- **Broad internal focus** involves thinking, planning, or analyzing (e.g., when analyzing information from a scouting report of an opposing team). The goal is to make sense out of a lot of information. This type of focus may also involve broad attention to the body through scanning for muscle looseness and warmth, comfort, and coordination.
- **Narrow internal focus** is required when rehearsing a personal act of performance before doing it (e.g., when an athlete considers what to do if the ball is passed or hit to him or her). This level of attention is also useful when a player shifts to a narrow physical focus, such as his grip on a golf club or bat, her core tension level and breathing, or his foot position or balance.

- **Broad external focus** is used when an athlete is monitoring what is occurring around him or her. For example, a softball player uses this focus when deciding where to hit the ball or checking the position of the outfielders or base runners. A soccer player uses it when checking the position of the nearby players while dribbling into open space or the position of the goalkeeper when shooting.
- **Narrow external focus** is about reacting and performing. In soccer, if a player is dribbling down the flanks and the ball is crossed, the other players' attention narrows while positioning to receive or one-touch the ball. During putting in golf, the player's attention shifts from finding a line for the putt to executing the shot with feel and confidence.

Typically, attention rapidly shifts among these four areas. Playing in the zone happens when attention shifts effortlessly and an athlete is strongly locked in on a narrow external or internal area. Generally, when playing well, a player shifts attention less frequently and his or her focus is more external, with less time "in his or her head." Athletes often describe the experience as automatic thinking—"It just happens." In contrast, poor performance often happens when a player's focus is mostly internal and he or she is thinking and analyzing excessively.

When a player's attention is predominately external, performance seems automatic. At these times, the sense of control and predictability is enhanced. During choking, focus is usually too internal and analytical so that situations do not seem clear, and anticipation and attention shifting are difficult. For improved attention, therefore, the goal in practice and competition is to move steadily toward a narrowing, external focus. To move along a continuum toward a narrow external focus, the athlete needs to develop ways to shift from the analyzing brain to an external target. This involves identifying distractions and refocusing attention. No athlete is able to stay in the zone all or even most of the time. The goal, therefore, is to build momentum toward the development of concentration skills and the ability to quiet distractions. Sports psychologist Shane Murphy (1996) suggests using the four Rs when distracted: react, relax, reflect, and renew. These techniques should take only a few moments and can be used in virtually any situation:

- **React:** Athletes often get upset when mistakes are made. They need to allow the emotional reaction to surface and be released, but keep it controlled and in perspective.
- **Relax:** Athletes should use one of the following methods to help settle down after the mistake: positive self-talk, clearing breath, muscle relaxation, imagery, or inner focus.

- **Reflect:** Athletes need to figure out what interfered with performance, then move on. For example, if the ball came faster or higher than expected, an athlete must make an adjustment for the next play.
- **Renew:** Athletes need to refocus, with the goal of shifting from an internal, in-the-head focus to a narrow, external focus, as before the error was made.

Case Study: I Get Mentally Fatigued and Lose Focus at the End of Games

A junior club ice hockey goalie and a collegiate soccer goalie each became mentally fatigued late in their games and gave up late goals.

Intervention: Both goalies were introduced to the importance of taking attention breaks during the course of each game by using the phrase "lock and release." They were taught that while the puck or the ball was near the opposite goal, they should give their visual-perceptual system a short break (i.e., a release) by looking down blankly and sending attention narrowly to their core and by taking one or two strong clearing breaths while moving easily in front of the goal. Following this break, they should then lock back into the external action either broadly or narrowly.

Case Study: I Can't Control My Anger

A nationally ranked junior tennis player and a competitive high school golfer were both having frequent breaks in attention and drops in performance due to anger over bad shots.

Intervention: Both were instructed to develop an attention shifting routine to get over the mistake and continue playing point to point or shot to shot. The tennis player learned to turn away from the court and say "breathe," then squeeze his racket with both hands while breathing in through his nose, and then let go of the bad shot and frustration or anger while breathing out. The golfer was instructed to walk up the course, allowing a release of emotion with a strong exhalation, until she reached a certain landmark in the fairway (tree, yardage marker). At that landmark, she quit thinking about the mistake and moved on to making a good recovery shot.

Case Study: I Can't Put Up a Soft Shot; I Think I'm Too Tight

A collegiate basketball center was having difficulty making her free throws, frequently putting up hard shots ("bricks").

Intervention: She adopted a new preshot routine, using multiple clearing breaths and visual and balance shifting. She started each free throw in a good balanced position on the line with a strong internal focus, completing one full breath cycle. Her focus would then go external during inhalation to visually scan the other players in the lane. Her attention then shifted internally to her hands as she slowly expired and dribbled the ball four or five times. Finally, she looked up to the basket and took in a deep breath while locking in on a narrow visual focus (the back of the rim). She completed the shot while exhaling partially or holding her breath. This routine reduced physiological activation and released tension so she could put up a soft shot.

Brain Imaging Research

Most talented athletes learn quickly that technical repetitions are one of the main keys to performing critical athletic movements well while under pressure. Basketball players usually shoot hundreds of free throws on their own time each week, and middle infielders in baseball and softball take dozens of extra ground balls each day to improve. These repetitions allow the mind of the high-achieving athlete to remain cool and focused. A study by Milton et al. (2007) showed that during motor planning, the fMRI brain activation patterns of expert golfers were markedly different from those of novice golfers. Specifically, expert golfers had much simpler activation patterns in the visual, premotor, and motor areas, whereas the novices had additional activation of areas associated with emotions and emotional memory. Another fMRI study by Wright et al. (2010) demonstrated that in cortical areas associated with observing and understanding others' actions, the activation patterns of expert badminton players to anticipating stroke direction from a brief video clip were stronger than those of novices.

Visualization and Imagery

Mental imagery or visualization involves imagining oneself practicing a task (e.g., a golf swing or football pass) using sight and feel without any (or with limited) physical movement. This technique is now widely used by athletes and coaches at all levels in individual and team sports, such as golf, tennis, baseball, and soccer (Beswick 2001; Dorfman 2000; Dorfman and Kuehl 1995; Rotella 2004). Support for this technique comes from fMRI research in which actual and imagined motor repetitions were compared and found to show identical supplementary, premotor (action planning), and primary motor (action execution) cortical area activation patterns, but different activation patterns in feedback (frontal lobe somatosensory) and opposite-side posterior cerebellar (motor inhibition) areas (Lotze et al. 1999; Nyberg et al. 2006).

Critical movements in all sports involve activation of the brain's visual and perceptual systems and their links to cortical and subcortical (cerebellum, midbrain, and brain stem) motor control areas. As athletic movements progress, feedback from the somatosensory cortex (in front of the motor cortex) is activated, linking with specialized posterior parietal areas for visual and spatial integration to correct actions during

sports with either continuous play (soccer, lacrosse, tennis) or interrupted play (golf, baseball, football). Motor repetitions in practice are a key to success in athletics so that automatic play (the seamless left-to-right brain shift mentioned in the opening section of this chapter) occurs during competition without interference from negative thinking or emotions. Early motor repetitions in childhood produce a basic muscle memory foundation that allows for more sophisticated movements to be added as experience increases.

Case Study: I Have Regular Images of Shanked Punts

A punter on a college football team was plagued throughout his career with inconsistency and recurrent negative images of shanking punts short and to the right.

Intervention: As part of a revised prepunt routine, the player was taught to break down the act of punting into small manageable steps ("snap, catch, lock, step, drop, and kick"). He set about saying these words and seeing himself repeatedly punting correctly when relaxed at home and at practice with good follow-through and long hang time. This combination of positive self-talk and visualization resulted in steady improvement in his consistency.

Case Study: If I Don't Stop Dropping Passes, I'll Be Dropped From the Team

A wide receiver on a professional football team was having problems with dropping the ball in practice and in games.

Intervention: In addition to improving his preplay relaxation and attention shifting skills, this athlete began daily visualization sessions during preseason camp. For 3–5 minutes each day, he would see himself surveying the defense, clearing out his tension, running his routes well, and looking the ball into his hands. As he worked on this revised routine more, his confidence and performance began to rise and he began making catches with consistency.

Case Study: If I Want More Playing Time, I Need to Improve My Goal Scoring

A college soccer athlete who played outside midfielder and forward had low confidence when attacking and shooting on goal. She would commonly engage in negative self-talk and imagine negative outcomes (shots struck poorly, blocked, or missed wide or high).

Intervention: She learned to use visualization of a current positive in her game (i.e., challenging for balls in the air on defense) and of goals scored in prior games and in practice as a basis to begin a daily regimen of visualizing strong, confident attacking with well-struck shots on frame. After the player used nightly visualization for a few weeks, her confidence began to rise and she attacked with greater certainty and success.

Brain Imaging and Brain Wave Research

Electroencephalographic (EEG) brain wave patterns and fMRI brain activation patterns are not the same for expert athletes as they are for less skilled athletes. In an fMRI mental imagery study of golfers with handicaps ranging from 0 to 16, Ross et al. (2003) found expected activation patterns in visual-perceptual, planning, execution, and error detection areas in all golfers, but far less activation of the cingulate gyrus or basal ganglia in experts than in novices. In addition, golfers with low handicaps had less overall activation with swing visualization than did golfers with higher handicaps, suggesting that the former had a simpler, more focused brain pattern. A preliminary study by Quencer et al. (2003) using portable EEG biofeedback also supports this finding by showing that expert golfers, compared to students, had a detectable quiet time just before hitting a shot. This quiet time may well indicate that an automatic swing has been learned, making more consistent ball striking possible. Using EEG, electromyography, and measures of muscle strength and power, Fontani et al. (2007) compared three groups of trained adult karate students learning a new skill over a month (i.e., students practicing the skill, students visualizing the skill, and control students who did not practice or visualize). The visualization group showed positive changes in muscle strength, power, and work similar to those of the action group but did not improve on reactivity. In addition, electromyographic findings documented changes in the movement-related brain macropotentials over time.

Motivation and Persistence

As athletes move from one competitive level to another, they discover that 1) more time is required and expected; 2) the competitors are more talented, athletic, and skilled; 3) fitness training and practice are more intense; and 4) the speed of play and competitive pressure are substantially greater. The athletes do not necessarily know or learn that desire, commitment, and persistence become vital to their long-term success. Each jump in competitive levels—from recreational to club, high school to college, or college to professional sports—requires an adjustment period that can last up to a full year or more. During this adjustment period, high-achieving athletes typically develop a stronger commitment to the sport and develop a formal improvement plan. Dorfman and Kuehl (1995) describe the critical sequence in high achievers as an inner desire to get better, the development of goals that allow that to happen, and unwavering dedication to future success. Many athletes also discover during these transitions that the mental and emotional aspects of sports become

more important. In addition, some young athletes begin to question whether they want to commit to additional hours of training and competition and to worry about the loss of time in other important areas of their life, such as socialization, family, leisure, or academics.

Case Study: I'm Not Sure I Want to Play Soccer in College

A high school sophomore forward on a high-level club soccer team wasn't sure she wanted to continue playing on the team or play in college even though her club coach and mother were encouraging the further development of her talent. She was worried that she would not have time for studies or just having fun.

Intervention: The sports psychiatrist and player discussed the positives (teammates, socialization, competition, team success) and negatives (not enough time, practices too repetitive, player and coaching changes, injuries) of playing soccer. The psychiatrist emphasized the importance of having fun and good life balance. Together, they developed a set of simple short-term (1–3 months) and intermediate-term (6-month) goals. The athlete decided she wanted to improve her fitness in the short term and her attacking skills and leadership in the intermediate term, and then she would decide on continuing or quitting. Just knowing that she had the option to quit and permission to prioritize other life areas (friends, school) seemed to create new energy and enthusiasm, and she ultimately decided to continue playing.

Complex Mental Skills

Goal Setting

Most high-achieving athletes have a formal system to evaluate performance and improve play (Porter 2003; Porter and Foster 1990). The main intent of such evaluation systems should be steady improvement rather than perfection. These systems are created with specific preseason, in-season, and postseason goals in mind. Goal setting is a formal process that allows athletes at all levels to periodically assess strengths and weaknesses. Weaknesses then become targets for improvement. Goal setting means aiming to achieve a specific level of performance in a certain amount of time using a written action plan. Goals can be short term (30 days), intermediate (6 months), or long term (1 year). Individual goals should be chosen freely without strong external pressure; each goal, large or small, should be something internal that generates interest and excitement. The seven important steps to effective goal setting are listed and discussed below. Each goal must be accompanied by at least three specific action steps that are worked on regularly.

1. **Set goals that are specific and measurable.** Use numbers to specify exactly what to do and to enable measurement of gains.

   Examples: "Increase my soft toss hitting from occasionally to three times per week for 20 minutes." "Increase my touches on the ball from 20 to 30 per soccer game." "Increase my movement off the ball so that I get five additional open looks at the basket per practice."
2. **State each goal in positive terms.** Phrase goals to indicate what to do rather than what to avoid.

   Examples: "Increase quality shots on goal" rather than "Reduce shots off frame." "Increase the number of good at-bats or hits" rather than "Reduce the number of strikeouts."
3. **Set goals that are challenging but realistic.** Find the right balance between pushing for success rather than setting up for failure. Overly difficult goals will lower self-confidence.

   Example: "Increase my pass coverage intensity" rather than "Don't ever get beat by the wide receiver."
4. **Establish a timetable for completion.** A timetable allows for checks on progress and for devising goals that are realistic.

   Example: "Off season—Improve my touch on the ball through daily juggling and drills. Improve my foot speed by doing plyometric training 3 days a week. In season—Increase my assists by 20%. Win 50% more balls in the air."
5. **Personalize and internalize each goal.** Each goal must make sense and be adopted for positive self-improvement rather than forced by a parent or coach. Seek input from others when choosing or modifying goals.
6. **Monitor and evaluate progress.** Obtain regular feedback to determine progress. Chart results on an index card or graph. Ask others to help record results, such as good contact with the ball in baseball or softball. Progress may require that goals be modified.
7. **Link athletic goals to life goals.** Goal achievement should allow sports to be seen in a broader life context. Improvements in teamwork, discipline, commitment, and patience can lead to academic success and improved relationships.

An athlete should work on two or three goals at a time. For each goal, a time frame should be determined, the goal's purpose should be defined, and specific action steps should be developed. Figure 2–2 shows examples of intermediate- and long-term goals and action steps for a soccer player.

Self-Evaluation

Successful athletes have organized approaches for reviewing and evaluating the positives and negatives of play in practice and competition (Por-

Intermediate-term goal (6 months)

As a central defender, I want to improve my play in the air. This means anticipating well, getting into better position, challenging more strongly, and clearing the ball or directing it to my teammates. I will improve my strong challenges in the air during scrimmages and games by 50%. This improvement will allow me to break into the starting lineup.

Step 1. Have a partner deliver 25 crosses for heading three times per week.
Step 2. Have a partner toss balls for heading for 10 minutes three times per week.
Step 3. Head juggle 200 times per day, working up to 100 continuous juggles.
Step 4. Strengthen core muscles with large-ball stabilization exercises three times a week.
Step 5. Improve vertical leap with vertimax training three times a week.
Step 6. Improve agility and balance with wobble board training for 15 minutes every day
Step 7. Visualize successful play in the air for 5 minutes every day.
Step 8. Watch several soccer matches and note the techniques of skilled defenders.

Long-term goal (12 months)

Improve my shooting on goal by attacking the box more aggressively, isolating defenders one on one, shooting more quickly, and picking up a strong target in the back of the net. This will allow me to average three quality shots on goal and score one goal per game.

Step 1. Practice shooting on goal alone for 20 minutes a day three times a week.
Step 2. Dribble and practice one-on-one moves for 15 minutes three times per week.
Step 3. Play in an indoor league over the winter.
Step 4. Participate in small-group tactical training twice weekly over the summer.
Step 5. Improve first-step quickness through year-round plyometric training.
Step 6. Improve flexibility by developing a new pregame warming and stretching routine.
Step 7. Practice turning on goal and shooting against a defender for 30 minutes a week.
Step 8. Watch 30 soccer matches and/or goal scoring highlights.
Step 9. Visualize successful shots daily for 5 minutes in the days before each game.

FIGURE 2–2. Examples of goals and action steps for soccer.

ter 2003; Porter and Foster 1990). These can include watching films, completing a postgame evaluation form, and/or discussing the game with parents, teammates, coaches, or a sports psychologist or mental skills trainer. An immediate purpose of the review is to identify technical areas for improvement and specific actions for skill development during

the next few training sessions. Broader purposes are to stay positive and humble, to assume responsibility for results, to focus only on those areas that are controllable, and to commit to ongoing improvement.

Case Study: I Can't Play as Well After Being Away

A high school and club soccer player (a forward) was just returning to play after a broken arm had kept her away from training and competition for 3 months. She had lost her fitness and confidence and was demoted to a lower-level club team because of inconsistent play.

Intervention: She committed herself over a 2-month period to improve her fitness, speed of play, and touches on the ball. After each game, she completed a game review form that consisted of 1) the positives of her play (in technical, tactical, and mental areas) and how they helped her and the team, and 2) the negatives of her play and what she did to try to overcome these. In addition, the sports psychiatrist asked her to identify three areas to work on during practice the following week. Regular follow-up meetings were held every few weeks over the entire season. This systematic approach to improvement helped her to get back on track with her fitness and technical training and to regain her playing confidence.

Precompetition Routine

An athlete who is well prepared every time he or she competes sets the stage for consistent, high-level performance. Preparation increases the likelihood of success and reduces mistakes. A precompetition routine includes organized actions from awakening until a competition begins. These routines vary with the time of the competition (day or night) or its location (home or away). Developing a slightly different routine for each circumstance is useful. Routines are not rituals; they are adaptable and adjustable depending on the situation.

Precompetition routines have three stages: wake-up, arrival at the field, and final preparation. Each stage contains physical and mental components. The wake-up stage addresses nutrition and equipment. During this stage, an athlete or team needs to confirm that everything that needs to be taken to the field has been gathered and checked for wear and tear. Items might include socks, cleats, uniform, ball, gloves, and so forth. Other components of this stage include energy production, hydration, meals, meetings, cardiovascular system activation, stretching, and treatment. Mental preparation during this stage involves reviewing the opponent or finalizing strategy and style of play. Some athletes also engage in relaxation, meditation, music listening, movie watching, or journal writing.

After arriving for competition, an athlete needs to warm up and stretch before engaging in organized drills, such as throwing, kicking, hitting, passing, or shooting. All fitness and technical drills should lead to a quiet mind, relaxed body, increased energy, and narrow focus. If

time permits, an athlete can do extra work on a specific skill that was identified in the postcompetition reviews.

During the final preparation stage, fine-tuning is usually all that is necessary. Each athlete makes adjustments to his or her strategy, relaxation, positive thinking, or imagery. Bull et al. (1996) divided the final phase into three distinct parts: preparation (mainly physical—occurs during warm-up), focusing (mainly visual—occurs just after warm-up), and execution (mainly positive talk—just before competition). Attention cues (physical, visual, or verbal) are used during this stage to strengthen preparation. These cues help with relaxation, concentration, and intensity regulation. No set cues are used; instead, unique groups of cues are used by each athlete. Physical cues require doing something specific and narrow (e.g., grabbing some grass, pulling up socks, staying on toes, taking a deep breath). Visual cues involve intense focus on something narrow and external in the environment (e.g., the athlete's locker, a picture, a word phrase, the writing on the ball, cleat laces, an advertisement, the net of the goal). Verbal cues are single words or word phrases that are repeated silently (e.g., "be ready," "play hard," "protect the goal," "be aggressive," "focus," "relax and go").

Case Study: I Don't Take Enough Energy Into the Game

A professional late-innings relief pitcher was having difficulty getting his energy up and his focus sharp before entering the game.

Intervention: An inning or two before it looked like he might enter the game, the player started visualizing himself dominating the hitters with location and power. He began to activate himself physically while still seated by chewing tart gum, doing brief (10-second) sets of nasal hyperventilation, and stretching and then releasing the large muscle groups of his back and shoulders several times with strong clearing breaths. He further activated himself mentally by visually locking onto a narrow external target, such as home plate or a spot on the fence, and then releasing in sync with a breath cycle. When he got up to throw, he did some additional sets of rapid breathing with progressive core tightening, followed by strong clearing breaths. Between warm-up pitches, he took one strong clearing breath, then repeated a positive statement ("dominate") while giving his visual system a break from looking at the bullpen catcher and mitt. This revised routine resulted in raised energy, sharper focus, and improved confidence.

Case Study: I Can't Score If I Can't Make Putts

A club professional golfer was having difficulty with putts and chips during tournaments. Although he had tried different putters and grips, he was still giving away too many strokes.

Intervention: His prechip/preputt routine was reviewed and revised to make sure he released excess muscle tension and narrowed his focus. To lock onto his target and line more strongly, he introduced a strong clearing breath while still standing behind the ball. On inhalation, he would tighten his grip on the club slightly, survey the green, and see the line, whereas on exhalation, he would lock onto the line and the target while releasing his grip and saying "see it" or "lock in." He repeated this routine while standing over the ball, except this time he would say "make it" on exhalation. This revised routine seemed to raise his confidence by clearing tension and doubt and replacing them with solid focus and certainty.

Brain Imaging Research

Mental skills training was introduced in individual sports such as golf, tennis, and track many years before its use in team sports. Preshot (golf), prereturn/pre-serve (tennis), and prerace (sprints, middle distance) routines have long been recognized as keys to success, with a shot-to-shot emphasis in golf, a point-to-point emphasis in tennis, and a lap-to-lap emphasis in track. As mentioned previously, in the "Focus and Attention Shifting" section, an fMRI study by Milton et al. (2007) showed that motor activation patterns during the preshot routine were much simpler in expert than in novice golfers. The authors concluded that experts in golf achieve "focused and efficient" neural networks through their preshot routines and repetitions from practice and play.

Emotional Control and Intensity Regulation

Emotional control and intensity are difficult to maintain during practice and competition for both individual and team sports. For individuals, mistakes often trigger quick emotional reactions, such as fear, frustration, anger, or disappointment, from automatic (subcortical) brain areas. These quick emotions may be followed by additional mistakes (e.g., hitting another poor shot in golf, giving up a second home run in baseball, committing a needless foul in soccer or basketball) unless the athlete adopts a planned behavioral approach to prevent these reactions. Intensity is a complex blend of determination, energy, work rate, and focus. It cannot be raised quickly but rather must be raised during pregame warm-ups or at half-time by clearing the mind of distractions (including poor play), relaxing the body, raising the energy, and narrowing and focusing attention. In team sports, members may have difficulty starting or continuing to play with a consistent intensity level. Therefore, runs in basketball, momentum shifts in football, and goals in soccer often occur when one team's intensity level rises well above that of the other.

Case Study: I Can't Let Go of Mistakes

A collegiate soccer player regularly lost her intensity during competition after an early and simple mistake on defense or in the attack. The mistake

led to quick disappointment and self-doubt that turned on her analyzing left brain, dramatically slowing her speed of play and decision making.

Intervention: The athlete created images of positive play from reviewing games and practices via film and discussion. She reinforced these images of power, certainty, and confidence with strong positive phrases, such as "power up" or "take someone on." Over time, she learned to use these images and positive self-talk before and during competition to prevent drops in her intensity and to maintain a positive attitude.

Conclusion

Recent advances in brain science, especially functional brain imaging and brain wave biofeedback, provide a strong evidence base to support the integration of mental preparation into an overall approach to training and competition that has previously focused on physical, technical, and tactical areas. Newer approaches such as life balance skill development, stress control, and mental skills training can be easily introduced into the fitness facility, training room, or practice areas in collaboration with athletic trainers, nutritionists, coaches, strength and conditioning staff, and team physicians and chiropractors. This chapter describes some behavioral and emotional traits of high-achieving athletes and the use of a set of basic and complex mental skills to enhance performance. Examples from different sports illustrated the actual application of these skills to a wide range of problems with performance. As new portable imaging and biofeedback technology becomes available, more specific measures of the positive effects of mental preparation on performance can be documented during practice or competition.

Key Clinical Points

- Five basic mental skills—breathing and relaxation, positive self-talk, focus and attention shifting, visualization and imagery, and motivation and persistence—can be used to enhance individual and team performance.
- Five complex mental skills—goal setting, self-evaluation, precompetition routine development, intensity regulation, and emotional control—are critical to competitive self-confidence and consistent play.
- Five emotional competencies—control, self-awareness, internal motivation, empathy, and socialization—are necessary for intensity regulation, overcoming mistakes and disappointment, burnout prevention, and team unity and resilience.
- The following nine behavioral traits, remembered using the acronym BELIEVE IT, are associated with high-achieving athletes: **B**alances, **E**ncourages, **L**ets go, **I**magines, **E**njoys, **V**isualizes, **E**valuates, **I**ntensity, **T**alks positively.
- In evidence-based cognitive profiles from neuroscience, three cognitive traits—high effortless attention, low reactivity to pressure, and high letting go of mistakes—are associated with steady improvement in competitive play; these traits comprise the ideal personality profile for an athlete.
- Three practical breathing techniques that emphasize exhalation—patterned relaxation breathing, nasal hyperventilation, and the clearing breath—can be used to control arousal and anxiety, reduce muscle chain tension, and improve focus and attention shifting.
- Positive word phrases that fit within the rhythm of the sport, trigger positive emotions, and turn on positive images can be used to maintain positive play or shift play from a negative to a positive pattern.
- Brief but regular mini-breaks during competition are necessary to maintain focus and attention shifting.
- Daily visualization of positive practice and play, if paired with partial movement, activates the same brain areas as actual athletic repetition and therefore builds muscle memory.
- Sports goals should be freely chosen, specific and measurable, stated in positive terms, challenging but realistic, personalized and internalized, and monitored and evaluated.
- Precompetition routines are effective when they quiet the mind, relax the body, balance energy, control emotions, and narrow focus and shift attention.

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Chapter 3

Stress Recognition and Control

Athletes, especially those at higher competitive levels, perform repeatedly under a spotlight and have their personal lives examined under a microscope. They must adapt to unpredictable events and situations in short time frames while meeting the high expectations of themselves and others. They must perform and produce and look good doing it.

Athletic training and competition are demanding, often requiring year-round commitment and self-sacrifice for athletes to perform with consistency under changing competitive circumstances. The unique demands of competitive sports, such as performance expectations, long practices, infrequent days off, changing schedules, travel, family separations, lack of privacy, media attention, exhaustion, and injury, must be managed with other priorities in life, such as relationships, family, children, financial security, and future education or career planning. Therefore, at times during a playing season, the demands of life and sports may temporarily exceed an athlete's ability to cope, and day-to-day functioning and performance may suffer. Recognizing the early symptoms of stress is often the first step for preventing performance drops and maintaining general functioning.

At its most basic levels, stress is necessary for survival and personal growth and development. At low to moderate levels, stress is positive, time limited, and manageable; however, at higher levels, it is additive and disruptive to relationships, performance, and health. Stress produces strong physiological reflexes that prepare the mind and body to meet nonroutine demands. The nervous system's energy level rises, emotional intensity increases, problem-solving brain systems activate, and hormonal patterns change. Fortunately, an equally powerful counterbalancing relaxation reflex exists. This reflex slows heart rate and breathing,