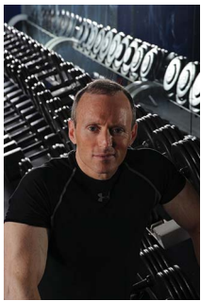

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Attentional Focus for Maximizing Muscle Development: The Mind-Muscle Connection

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ABSTRACT

ATTENTIONAL FOCUS IS A WELL-RECOGNIZED ASPECT OF MOTOR LEARNING AND ITS USE HAS IMPORTANT IMPLICATIONS TO THE FITNESS PROFESSIONAL. THIS ARTICLE WILL DISCUSS HOW ATTENTIONAL FOCUS SHOULD BE DIRECTED TO MAXIMIZE MUSCULAR DEVELOPMENT.

Attentional focus is a well-recognized aspect of motor learning and its use has important implications to the fitness professional. Simply stated, attentional focus refers to what an individual thinks about when performing a given movement or activity. Two primary types of attentional focuses have been identified: internal and external. With an internal focus, the individual thinks about bodily movements during performance. Alternatively, an external focus directs the exerciser's attention to the environment. For example, in the squat an internal focus could be to "squeeze your glutes as you ascend" whereas an external focus could be to "drive the floor away from your body." This article will discuss how attentional focus should be directed to maximize muscular development.

ATTENTIONAL FOCUS RESEARCH

A compelling body of research indicates that performance-oriented tasks are optimized by adopting an external focus of attention. In a recent review of literature encompassing over 50 published studies on the topic, Wulf (12) found that more than 90% of these studies showed superior improvements in motor learning when subjects used an external compared with internal focus. Beneficial effects were seen across a wide variety of activities and outcome measures, lending strong support for the use of an external focus when the goal is to boost performance.

With respect to resistance training, the performance-based superiority of an external focus has been attributed to an enhanced economy of movement associated with greater force production and reduced muscular activity (5). However, whereas a more economical movement pattern facilitates better skill acquisition, it may not be optimal for muscle development. Indeed, when the goal is to maximize hypertrophy, indirect evidence suggests that an internal focus may be the best approach.

Bodybuilders have long preached the importance of developing a "mind-muscle connection" when training. This internally focused strategy involves visualizing the target muscle and consciously directing neural drive to the muscle during exercise performance. Theoretically,

such an approach would increase activation of the target muscle while diminishing contribution from secondary muscle movers. Indeed, research seems to support this contention.

A number of studies have shown greater activation of a given muscle when subjects were instructed to adopt an internal focus of attention. This has been most prominently displayed in the abdominal musculature. Karst and Willett (3) found that subjects were able to significantly alter mean electromyography (EMG) activity to either the rectus abdominis or obliques by consciously focusing on the respective muscles during performance of the curl up. Before engaging in exercise, subjects in this study were instructed on how to visualize either the rectus or obliques and verbal reinforcement of these instructions were provided during performance. A control condition involved focusing on the movement itself without regard to any specific muscles. These results are consistent with research showing increased activation of the transversus abdominis after instruction to tighten the pelvic floor muscles (2). Similarly, Bressel et al. (1) demonstrated that mean and peak EMG amplitude were significantly increased in both superficial and deep abdominal musculature during the squat when subjects were directed to "brace yourself as if you were going to be punched in the stomach."

Findings of heightened EMG activity from an internal focus have been noted in other muscles as well. Lewis and Sahrmann (4) showed that young women were able to achieve greater mean EMG activity of the gluteus maximus and reduced activation of the hamstrings when cued to contract the gluteal muscles during performance of the prone hip extension ("Use your gluteal muscles to lift your leg while keeping your hamstrings muscles relaxed"). Moreover, the timing of activation was altered so that the gluteus maximus was activated significantly earlier during movement. Likewise, research has shown that intentionally focusing on the target muscle resulted in higher activation of the latissimus dorsi, pectoralis major, biceps brachii, and triceps brachii (5,7–9). Interestingly, evidence seems to indicate that the increased activation does not always coincide with reductions in the activity of secondary muscle movers (7,8).

Although it remains unclear as to whether increased muscle activation translates into greater muscle protein accretion, emerging research indicates that this may in fact be the case. In a 2-part experiment, Wakahara et al. (11) first investigated acute muscle activation in 12 untrained men after a single bout of resistance training for the elbow extensors through T2-weighted magnetic resonance imaging. The exercise protocol consisted of 5 sets of 8 repetitions of lying triceps extensions with 90 seconds rest between sets. Results showed significantly greater activation in the proximal and mid-portions of the triceps brachii compared with the distal aspect. Another 12 subjects were then recruited to perform a 3-day-per-week program consisting of the same routine used in part 1 of the study. After 12 weeks of regimented training, increases in muscle cross-sectional area were found to be well-correlated to the areas most activated by the exercise regimen. Follow-up work by the same laboratory showed similar results using different triceps brachii exercises (10), which in combination provide evidence for an association between activation levels and muscle growth. It should be noted that these studies did not attempt to investigate muscle activation in conjunction with altered attentional focus, so it is unclear whether results would translate to the adoption of an internal focus. Moreover, the results of these studies are specific to the triceps brachii and thus cannot necessarily be generalized to other muscles.

Interestingly, the effectiveness of using an internal focus is reduced when training at higher loads. Snyder and Fry (7) found that activation of the pectorals was amplified by 22% when resistance-trained men were provided with verbal instructions to focus on the chest muscles during bench press at 50% 1 repetition maximum (1RM). However, the magnitude of this effect decreased to 13% when the same instructions were provided during performance at 80% 1RM. This may be a function of needing to exert greater levels of force when training at heavier loads, thereby altering one's ability to focus on the muscle being worked. Moreover, in accordance with the size principle, fewer motor units will be available for the mind to influence with heavy loading when compared with lighter loads. This suggests that adopting an internal attentional focus with very heavy loads (above 85–90% of 1RM) is unnecessary because it might limit force production without enhancing muscle activation, but more research is needed in subjects with varying levels of experience to explore this hypothesis.

PRACTICAL APPLICATIONS

Attentional focus should match the goal of the task. Competitive sport athletes should rely heavily on external attentional focus in practice and during games or matches. This includes powerlifters, weightlifters, or strongmen seeking to set a 1RM or to maximize force or torque production; basketball players or track & field athletes seeking to maximize jump height or distance; runners or rowers seeking to improve economy; and dart throwers, golfers, and pool players seeking maximum accuracy. Alternatively, when attempting to maximize muscle activation, an internal focus of attention would seem to be a better choice. Bodybuilders, physique athletes, and others seeking maximal hypertrophy will conceivably benefit by focusing on the target muscle during an exercise rather than on the outcome or environment. It is likely that the molecular signaling for all 3 primary mechanisms of muscular hypertrophy, namely mechanical tension, metabolic stress, and muscle damage (6), are increased when the exerciser focuses their attention internally, which could ultimately result in greater muscular development for a given exercise and load. The effects

of this strategy seem to be particularly beneficial when training with relatively light loads.

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