

# What Surgeons can Learn From Athletes: Mental Practice in Sports and Surgery

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**BACKGROUND:** Mental practice has been successfully applied in professional sports for skills acquisition and performance enhancement. The goals of this review are to describe the literature on mental practice within sport psychology and surgery and to explore how the specific principles of mental practice can be applied to the improvement of surgical performance—both in novice and expert surgeons.

**METHOD:** The authors reviewed the sports psychology, education, and surgery literatures through Medline, PubMed, PsycINFO, and Embase.

**RESULTS:** In sports, mental practice is a valuable tool for optimizing existing motor skill sets once core competencies have been mastered. These techniques have been shown to be more advantageous when used by elite athletes. Within surgery, mental practice studies have focused on skill acquisition among novices with little study of how expert surgeons use it to optimize surgical preparation.

**CONCLUSIONS:** We propose that performance optimization and skills acquisition should be viewed as 2 separate domains of mental practice. Further understanding of this phenomenon has implications for changing how we teach and train not only novice surgeons but also how experienced surgeons continue to maintain their skills, acquire new ones, and excel in surgery. (*J Surg* 71:262-269. © 2014 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

**KEYWORDS:** mental practice, imagery, surgeons, experts, surgical skills

**COMPETENCIES:** Practice-Based Learning and Improvement, Medical Knowledge, Patient Care

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## The Athlete

The videotape was not real. Rather, it was a mental visualization of the perfect race. Each night before falling asleep and each morning after waking up, Phelps would imagine himself jumping off the blocks and, in slow motion, swimming flawlessly. He would imagine the wake behind his body, the water dripping off his lips as his mouth cleared the surface, what it would feel like to rip off his cap at the end. He would lie in bed with his eyes shut and watch the entire competition, the smallest details, again and again, until he knew each second by heart.<sup>1</sup>

## The Surgeon

My motto is to visualize. For instance, I visualize myself cutting the skin and the fat, seeing what muscles are underneath, knowing what instrument I would use to cut with. Then I would think, "Oh yes, remember to get your cautery out, to burn the muscle instead of cutting it so you don't get complications afterwards with your blood clotting [the hematoma]...I always have a visual picture in my head when I'm doing something as to how I'm going to do it. It's like seeing all the tissues in three dimensions... A lot of the time I'll actually remember how it felt, how much I had to press, and how much I had to handle the tissue to get to the right spot."<sup>2</sup>

## INTRODUCTION

Performing surgery requires the execution of orchestrated fine and gross motor skills in a time-sensitive, high-stakes environment, much like performances in elite athletics. It is not surprising then that authors have drawn analogies between sports and surgery. In this context, the cognitive tools that elite athletes use to learn and enhance their performances may certainly be of benefit to surgeons. One of these tools is mental practice. Mental practice is the

conscious action of systematically and repeatedly imagining objects and movements without physically seeing or performing them with the intention of improving performance.<sup>3</sup> Other terms used to refer to this technique include mental or motor rehearsal. Within sport psychology, it has become an important area of research, meant to guide training and performance of both novice and elite athletes.<sup>4-6</sup>

Recently, researchers have considered how mental practice might be applied to surgical skills acquisition and improvement.<sup>7</sup> Several studies have recognized the benefits of mental practice within laparoscopic surgery,<sup>8,9</sup> gynecology,<sup>10</sup> and urology.<sup>11</sup> This research has demonstrated that mental practice has positive effects on the acquisition of new surgical technical skills.<sup>11-13</sup> However, there is very little data examining the role of mental practice for improving and enhancing established surgical skills.

The goal of this review is to describe the literature on mental practice within sport psychology and surgery. We start by highlighting the studies within sport psychology that have explored the use of mental practice among athletes at all levels of competition. The burgeoning work in surgical education is then reviewed and this research is compared between the 2 domains of sports and surgery. Finally, we discuss how this work can inform future studies within surgery to benefit the novice and the expert surgeon. Through this review, we explore how the specific principles of mental practice can be applied to not only the acquisition of surgical skills but to the improvement of surgical performance as well.

## METHODS

We reviewed the English language literature in sports psychology and surgery by searching PubMed, MEDLINE, PsycINFO, and Embase. The following terms were used individually or in combination: mental practice, mental rehearsal, visual imagery, surgery, and sports. The initial search yielded 83 articles. Further articles were found using reference lists and abstracts. Articles directly related to mental practice in sports or surgery as well as other areas, such as music and medicine, were reviewed. Forty articles relevant to mental practice in either sports or surgery were identified. Table summarizes the published randomized control trials within the surgical literature on this topic. We present those papers most relevant to mental practice, as a full review of each topic is beyond the scope of this article.

## MENTAL PRACTICE IN SPORT

Athletes commonly use mental practice to supplement physical practice and improve performance. Multiple studies have supported the benefits of mental practice in sports preparation within diverse sporting activities including darts, throwing, diving, figure skating, and gymnastics.<sup>14,15</sup> Feltz

and Landers<sup>16</sup> synthesized available data in the first comprehensive meta-analysis of the sports literature. An analysis of 60 studies compared mental practice with either no practice or with physical practice alone among a range of sports and experience levels. They concluded that mental practice was better than no practice but that mental practice alone was not as good as physical practice alone. Although there may be a synergy between mental and physical practice, physical practice remains essential as it provides vital corrective feedback, which leads to improved results.<sup>17</sup> Further studies have shown that the combination of physical and mental practice results in superior sports performance.<sup>6,14,18</sup>

Feltz and Landers<sup>16</sup> also found a significant difference in effect sizes between novice and elite athletes, suggesting that mental practice, although beneficial for learning new skills among inexperienced athletes, is *more* advantageous when used by elite athletes. Elite athletes use mental practice more frequently, have better visualizing abilities, and employ more structured mental practice sessions.<sup>19</sup> Novice athletes may mentally practice the wrong technique and thus reinforce poor form, which may then lead to poor performance.<sup>20</sup> This discrepancy could be the result of less experienced athletes not yet possessing sufficient schematic knowledge of successful task performances. Thus, mental practice may be counterproductive in this group.<sup>6</sup>

Athletes use mental practice to cope with anxiety and to build confidence.<sup>21</sup> This is achieved through arousal regulation, which is the ability to increase or decrease physiological arousal. Optimal levels of arousal improve physical performance by increasing perceptual selectivity and minimizing attention to irrelevant cues.<sup>15</sup> Arousal regulation can occur through “psyching up” strategies. Mental practice has been shown to be an effective tool for arousal regulation in weight lifting, running, and sit-ups. The technique can also be used to modify cognition and affect. For example, athletes might visualize themselves being successful or overcoming challenges thereby replacing negative images and negative self-statements.<sup>15</sup>

## MENTAL PRACTICE IN SURGERY

There are many similarities between competitive sports and surgery. Motor skills, a component of technical skills involved in surgery, are considered to be of paramount importance for both surgeons and athletes. Both surgeons and athletes perform—often under stressful conditions—complex movements while adapting to changing situations, constantly striving for perfection. Surgeons could also use these cognitive techniques used by elite athletes to optimize their performances as well. This may be particularly relevant for the experienced and expert surgeon. Although there is no uniform definition of expertise in surgery, we refer to expert surgeons as analogous to elite athletes—those who

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