Integrating Mental Practice with Task-specific Training and Behavioral Supports in Poststroke Rehabilitation

Evidence, Components, and Augmentative Opportunities

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KEYWORDS

• Mental practice • Motor imagery • Stroke • The PRACTICE principles
• Rehabilitation

KEY POINTS

- Mental practice involves mental rehearsal of physical movements without the use of physical practice.
- Mental practice has been shown to increase motor learning and performance in a variety of clinical and performance-related environments.
- Mental practice elicits the same neural and muscular events as physical practice. Therefore, if used repetitively, its use is thought to increase poststroke skill reacquisition.
- The PRACTICE (part-whole practice, repetitive and goal focused, activities that are salient, client driven, train practically, impairments addressed, challenge regularly, and emphasize accomplishments) principles can be used as a guide to structure the contents of mental and physical practice.
- Noninvasive brain stimulation can be used adjunctively with mental practice.

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Stroke remains a leading cause of death and one of the most costly and burdensome diseases.[1–3] For example, the 2010 Global Burden of Disease Study estimated that there were 16.9 million people who had experienced a first-ever stroke, 33 million stroke survivors, and 102 million disability-adjusted life-years lost in that year alone.[4] Moreover, despite organized efforts to prevent and treat stroke more quickly and effectively, since 1990 there has been continued growth in the overall incidence and mortality of stroke.[4]

The global impact of stroke and the rapidly expanding number of stroke survivors with residual disabilities[4] provide impetus for the development of rehabilitative approaches that increase poststroke function. In response, several rehabilitative regimens have been tested, with the most efficacious therapies[5–7] encouraging survivors to practice functionally and repetitively (termed repetitive task-specific practice [RTP]). RTP seems to be a critical factor in poststroke plasticity and functional increases.[8] For example, in stroke survivors with minimally impaired upper extremities (UEs), constraint-induced movement therapy increases UE use and function[5,7] by integrating RTP with behavioral strategies that encourage paretic limb use. Similarly, among survivors with moderate UE impairments (people with no active movement in their paretic wrists and fingers) RTP augmented by electrical stimulation enables active participation in UE motor practice, and significantly increases paretic UE use and function.[9–12]

Informed by these promising findings, and based on decades of motor learning, neuroplasticity, and cognitive behavior training literature, we recently proposed the PRACTICE principles,[13] which speak to the ways in which RTP should ideally be integrated into poststroke care. Specific components of the PRACTICE principles are as follows: (1) part-whole practice should be used, with an eye toward realistic task analysis, (2) repetitive and goal focused, (3) activities should be salient, (4) client driven, (5) train in a practical way, (6) impairments should be addressed, (7) challenge regularly and appropriately, and (8) emphasize accomplishments. One of the concepts elucidated by the PRACTICE principles is the ability of the client to easily access and meaningfully engage in RTP (ie, train in a practical fashion). This principle speaks to the match of a regimen's practice parameters with the abilities and physical activity tolerance of the client (eg, are the parameters too intensive and/or too long in duration for the client to tolerate? Does the regimen use equipment that the client and/or the clinic cannot easily integrate into care?), as well as the physical proximity and accessibility of the resources needed to fully implement the regimen. Such practical considerations are important in ensuring full client participation and high fidelity with the regimen to facilitate neural and motor changes. However, they are not always embraced by contemporary approaches, such as those mentioned earlier, which often require intensive parameters and/or expensive equipment that is only available at specialized rehabilitation and academic medical centers. For instance, in the largest trial to date of constraint-induced movement therapy, subjects could only tolerate about two-thirds of the assigned 6 hours of RTP before fatigue set in.[12]

In response to these limitations, this laboratory was the first to apply mental practice (MP) to increase learning and outcomes in stroke,[14] later showing that MP use increases paretic UE use and function.[15,16] More recently, our work has shown that MP use causes the same cortical changes as physical practice in survivors of stroke.[17] The regimen has also been extended to other poststroke impairments and neurologic conditions,[18–20] and our pioneering findings have been replicated by others around the world.[21–26] The critical advantage of MP compared with newer but less pragmatic rehabilitative approaches (and even some conventional rehabilitative therapies) is its use of cognitive rehearsal without the use of physical practice or voluntary physical movement attempts by the client. Instead, the client listens to an audio file that

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