

Example of literature review on evidence based approaches

[Psychology](#), [Success](#)



The power of thoughts: Evidence for Motor Imagery in upper-extremity rehabilitation, post-stroke and factors that contribute to its effectiveness in occupational therapy interventions.

Introduction

According to statistics recorded by the Ministry of Health Singapore (2009), Stroke is among the leading causes of death and disability with an incidence of 15 million new cases being reported worldwide annually (Ministry of Health Singapore 2009). It was further estimated established that 63% of stroke survivors continued to experience moderate to severe disability (Ministry of Health Singapore 2009: 7) . This disability mainly stemsstemmed from motor impairment (Sharma, Pomeroy and Baron 2006: 1941), and affecteding the upper-extremity (UE) contralateral to the side of stroke (Nakayama, Jørgensen, Raaschou and Olsen 1994).

Furthermore, it has been established that Occupational Therapists are instrumental in remediating the UE impairments to promote participation in activities of daily living (American Occupational Therapy Association 2008). However, it was posited that some of the current approaches (e. g. bobath approach) are frequently utilised even though there is a lack of evidence of their successes or failures (Dickson 2002). Therefore, Hence it is important to use evidence-based approaches to increase probability of successful outcome in-lieu of the uncertain recovery trajectory (Tomlin 2008: 96).

Rehabilitation based on the concept of neuroplasticity has been gaining popularity, especially with the possibility of improving outcome even in chronic stages of stroke (Duncan, Matchar, Divine and Feussner 1992).

Plasticity is an intrinsic property of the nervous system that is present throughout the human lifespan (Pascual-Leone, Amedi, Fregni and Merabet 2005). In simple terms Simply stated, neuroplasticity is a two-step process in response to environmental influences, afferent input and/or efferent demand (Pascual-Leone, Amedi, Fregni and Merabet 2005). It is primed by the reinforcement of pre-established organic pathways or partially damaged neural elements (in stroke) followed by the formation of new pathways through dendritic growth and arborization (Pascual-Leone, Amedi, Fregni and Merabet 2005).

Motor imagery (MI) is one approach based on current understanding of neuroplasticity which allows access to the motor system at all stages of stroke recovery (Jackson, Lafleur, Malouin, Richards and Doyon 2001). MI, as is defined by Richardson (1967: 95), is as “ the symbolic rehearsal of a physical activity in the absence of any gross muscular movements”.

Previous Rresearch has shown that MI and executed action shares an overlapping neural network (i. e. perirolandic cortical area) with MI showing a lower level of activation (Porro et. al. 1996; Jeannerod 2001). A similar increase in cortical representation and decrease in baseline motor threshold of the mentally practiced muscle, compared to physically trained muscles, was shown in a research by Pascual-Leone et. al. (1995). However, the level of activation of the primary motor cortex was approximate to be about 30% of that during executed actions (Jeannerod 2001: 104). Other essential overlapping areas activated by both imagined and actual execution are, according to Sharma, Pomeroy and Baron (2006: 1948), the premotor cortex (Sharma, Pomeroy and Baron 2006: 1948), parietal cortex, supplementary

motor area, cerebellum parietal cortex, basal and ganglia and cerebellum. A possible explanation to the working mechanism of MI could be derived from the 'Simulation Theory' proposed by Jeannerod (2001) based on his extensive research on motor cognition. He proposed that actions involve a covert (MI stage) and an overt stage (execution stage), and these two stages represents a continuum (Jeannerod 2001: 103). Every overt action must follow from a covert stage (future representation of action), which includes the purpose of the action, the course of action to achieve it and the possible outcomes (Jeannerod 2001: 103).

Additional similarities between MI and executed movements are close temporal coupling (i. e. time taken to mentally rehearse an action closely mirrors the executed movement), inverse relation between accuracy and speed (i. e. Fitt Law), asymmetry between dominant and non-dominant hands are preserved, and the activation of autonomic system.

A review of current literature consisting of systematic reviews, randomised-controlled trials and reference from clinical practice guidelines in general suggests that MI is an effective adjunct to conventional therapy, especially for UE rehabilitation for all stages of stroke (Royal College of Physicians 2012; Nilsen, Gillen, DiRusso and Gordon 2012; Schuster et. al. 2011; Nilsen, Gillen and Gordon 2010; Zimmermann-Schlatter, Schuster, Puhan, Siekierka and Steurer 2008; Sharma, Pomeroy and Baron 2006; Bell and Murray 2004). As its effectiveness has been supported by numerous clinical trials, current research mainly focus on exploring key elements that could influence effectiveness of an MI intervention.

These neuroscience evidence and theoretical understanding of MI lends

support to its clinical utility. The use of MI could attempt to bridge the period of poor motor performance (Sharma, Pomeroy and Baron 2006: 1941), fill the “ practice gap” between the amount of training these patients need and the amount they receive (Nilsen, Gillen and Gordon 2010: 696; Bell and Murray 2004: 506), and be used to accelerate the acquisition of new motor skills by providing a well-suited cognitive model in advance of any physical practice (Pascual- Leone et. al. 1995).

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Conceptualizing MI

When Schuster et. al. (2011) compared 133 studies across five different disciplines (i. e. education, medicine, music, psychology and sports) which utilized MI, dominant characteristic of successful MI intervention was extracted (refer to appendix one). Using their distilled results, some key elements will be further discussed with supporting evidence from other literatures.

Amongst all elements, perspective of imagination was the most widely discussed among literatures. There are essentially two perspectives that can be adopted when practicing MI; the internal (first-person) or external (third-person) perspective. Trend analysis revealed that internal perspective was the most dominant among successful MI interventions (Diagram 1.). It was suggested that MI performed with an internal perspective was preferred, as neural correlates were shown to be high and most closely resembled executed actions (Lorey et. al. 2009; Ruby and Decety 2003; Jeannerod 1995).

Diagram 1. Comparison of average positive motor imagery (MI) intervention versus discipline-specific MI intervention in Medicine for perspective and mode (Schuster et. al. 2011)

Modes of imagination were thought to correspond to perspective (de Vries and Mulder 2007). Callow and Hardy (2004) suggested that internal perspective can be done in a visual or kinesthetic mode, while external perspective is done in a visual mode. Visual imagery (VI) involves self-visualization of action, while kinesthetic imagery (KI) implies somesthetic sensation elicited by action (Guillot and Collet 2005). It is hence therefore not surprising to find that activation intensity during VI appears to be lower than that of MI and executed action (Porro et. al. 1996) (refer to diagram 2.). Likewise, KI was dominant in successful intervention as shown on trend analysis (Schuster et. al. 2011).

Diagram 2. Mean normalized signal intensity in the posterior portion of the precentral gyrus (Porro et. al. 1996: 7691)

Although majority of research with positive outcomes points to the use of

internal perspective with KI, positive outcomes achieved with external perspective and VI should not be discounted. A recent study by Nilsen, Gillen and DiRusso (2012) compared both perspectives in VI mode showed exhibited similar positive outcomes when used as an adjunct to occupational therapy for subacute stroke rehabilitation, suggesting that neither perspective has an edge over another the other.

This could be explained by Stevens' (2005) proposition that motor representation consists of both biomechanical and spatial coordinates. While KI represents the biomechanical constraints, VI represents the spatial coordinates (Stevens 2005), suggesting that both perspectives are valuable in their own ways (Nilsen, Gillen and Gordon 2010: 705). It could also be explained by the additional benefits of using external imagery; that it could enhance motivation (Vasquez and Buchler 2007) and self-perception, thereby influencing behavioral outcomes (Libby, Shaeffer, Eibach and Slemmer 2007).

Although no clear consensus could be reached from current research regarding the optimal perspective to use, there is a clear understanding across most studies that the ability to perform vivid MI (assessed by imagery vividness) is a crucial factor for consideration (Schuster et. al. 2011; Nilsen, Gillen, DiRusso and Gordon 2012). It was also found out that younger people tend to use internal perspective while older people perform MI more vividly by utilizing external perspective (Mulder, Hochstenbach, van Heuvelen and den Otter 2007).

On the other hand, the effectiveness of different mode was shown to be influenced by the type of task and stage of learning (Dickstein and Deutsch

2007: 945). It was demonstrated by Féry (2003) that VI is more suitable for task that emphasized form, while KI was better for task requiring coordination. The notion was also supported by Hall, Buckolz and Fishburne (1992) which suggests that KI is effective for practicing close-kinetic chain while VI for open kinetic chain motor skills.

Three other elements that are widely discussed and are closely related are position, location and focus. Trend analysis by Schuster et. al. (2011) (refer to table 1.) suggested that MI intervention should be task-specific motor activities. It was further supported by the “ law” of situational equivalence (Schmidt and Lee 2005), that similarities must exist between the learning or training context and the context of application (Mulder 2007: 1271).

However, close scrutiny of the medicine trend analysis statistics (refer to diagram 3.) revealed close results for both elements of position and location, suggesting that minor differences in results could be due to chance. A number of studies done recently on stroke patients utilized audio-taped script to facilitate the simulation of environment during imagination and was able to achieve positive intervention outcomes (Nilsen, Gillen, DiRusso and Gordon 2012; Dunsky, Marcovitz, Levy and Deutsch 2008; Page, Levine and Leonard 2007). This suggests that task-specific environment does not need to be physically present and could be simulated during imagination. It should also be noted that practicing MI in a task-specific environment will aid in vividness of imagination and should also be considered.

Diagram 3. Comparison of average positive motor imagery (MI) intervention versus discipline-specific MI intervention in Medicine for directedness, location and focus (Schuster et. al. 2011)

Integration and order are two important and related elements to consider when planning for MI programs. Most research done focused on using MI as an addition to physical practice (practice (PP)) (Schuster et al. 2012). Embedding MI into conventional therapy only started to gain popularity recently (Schuster et al. 2012), thus explaining the disparity in percentage of successful outcome as shown in the trend analysis (refer to digram 4). A comparison on effectiveness of addition or embedded MI was never done until 2012 by Schuster et al. (2012), which concluded that, both methods of integration are equally beneficial when used with physiotherapy. However, both integration methods have been shown to be successful when used with occupational therapy in different studies (Page 2000; Page, Levine, Sisto and Johnston 2001a; Page, Levine, Sisto and Johnston 2001b, Page 2001; Page, Levine and Leonard 2007; Liu, Chan, Lee and Hui-Chan 2004a; Liu, Chan, Lee and Hui-Chan, 2004b), further supporting the conclusion by Schuster et al. (2012).

Diagram 4. Comparison of average positive motor imagery (MI) intervention versus discipline-specific MI intervention in Medicine for Integration and Order (Schuster et al. 2011)

MI Success Measures

In any case, most research in the medical context arrived at a consensus that the combination of MI and physical practice (PP) (i. e. conventional therapy) is essential in bringing about an improvement in occupational performance (Schuster et al. 2011, Nilsen, Gillen, DiRusso and Gordon 2012; Ietswaart et al 2011). Improvement in occupational performance is also found to be greatest when MI is combined with PP,

followed by PP alone, MI alone and lastly, no practice at all (Dickstein and Deutsch 2007: 943). When integration of MI through addition to conventional therapy is used, it should be done after physical practice as trend analysis suggests that it leads to a higher probability of successful intervention outcome (refer to diagram 4.), although the mechanism of success was not understood.

Other elements for successful MI intervention based on trend analysis includes, individual, non-directed, supervised session with live, acoustic and detailed instructions with clients closing their eyes during practice (refer to appendix 1.). These elements were less or not discussed in literature therefore suggesting that consideration of these elements, when implementing MI, should be based on clinician's discretion until further research can confirm otherwise.

Diagram 4. Comparison of average positive motor imagery (MI) intervention versus discipline-specific MI intervention in Medicine for temporal parameters

MI in Practice

Trend analysis for temporal parameters in the domain of medicine for MI suggests six sessions per week over a period of approximately 4 weeks, with each session lasting about 23 minutes and an approximation of 33 MI trials per session (Schuster et. al. 2011). These parameters should be referenced with caution as it was suggested that treatment protocols varies significantly across studies (refer to diagram 4 for standard deviation), with each catering for specific group of patients (Dickstein and Deutsch 2007: 948; Schuster et. al. 2011). However, as a rule of thumb, MI was found to be effective when

the imagined movement is short and simple (best to focus on one limb), with many repetitions in a short concentrated period (Schuster et. al. 2011).

Having explored the elements and temporal parameters for effective MI intervention, however, it should also be noted that MI is not a suitable intervention for all patients with stroke. It was suggested that certain levels of cognition (usually assessed by mini mental state examination) is required to ensure adequate cognitive processing of instruction to ensure completion of task (Wu, Hermann, Ying and Page 2010: 930; Nilsen, Gillen, DiRusso and Gordon 2012: 321). Ability to imagine has obvious correlation with MI effectiveness. It was found that patients with parietal lobe lesion were less accurate in their ability to imagine as the parietal cortex is essential for generating mental representations of movements (Sirigu and Duhamel 2001). Lastly, intact working memory is also essential as MI requires the manipulation of visual and kinesthetic information in the working memory (Malouin, Belleville, Richards, Derosiers and Doyon 2004).

In conclusion MI has been shown to be effective for UE rehabilitation for patient at all stages of stroke and as an adjunct to occupational therapy. It is essential to consider the elements and temporal parameters which could influence successful intervention outcome when planning for MI intervention programs.