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Revisiting the core principles of physical rehabilitation after stroke: It's not only what you do but how you do it that matters

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Editorial - Revisiting the core principles of physical rehabilitation after stroke: It's not only what you do but how you do it that matters

Background

In the second of two linked editorials, we build on the discussion of interventions for motor rehabilitation after stroke recommended by the UK 2023 National Clinical Guidelines for Stroke.[1] Specifically, we will explore the key elements of motor learning[2] which underpins repetitive task practice, one of two principal rehabilitation approaches (the other being exercise) recommended in the UK Guidelines for motor recovery.

Repetitive task practice, which appears synonymous to task-oriented training,[3] can enable individuals with some activity in their upper-limb to actively practice movements and is informed by skilled movement analysis (as discussed in editorial 1). For patients with no activity or those who are unable to select or activate movement without significant assistance (apraxia, significant sensory loss, inattention) the approach would be different and so will not be explored in this editorial.

Repetitive task practice and motor learning

Repetitive task practice is frequently recognised as including many hundreds of repetitions of task or goal-oriented movements. Importantly, these repetitions are not identical but comprise incremental challenge and should be engaging to build on previous attempts to refine existing and generate new strategies for movement. This explicitly recognises that repetitive task practice requires a detailed understanding of *how* someone moves, rather than a sole focus on task completion, and an engaging environment conducive to intensive practice.[2]

In addition to promoting a high number of repetitions, the motor learning theories that underpin repetitive task practice highlight that interventions should include five other key elements:[4]

Specific – training should be goal directed with clear parameters targeting the chosen element of movement. Ongoing skilled movement analysis enables the design of an exercise or task set-up that

directly links to an individual's specific goals and function to ensure they are meaningful to each individual and that patients are motivated to practice intensively; accordingly, some goals can be targeted to achieve in a session, whilst others may span weeks or months.

Graded – the level of difficulty should be frequently altered so that individuals are continually challenged yet it is possible to achieve a threshold of success. This adaptation may include altering accuracy requirements, distance reached or repetitions within a timeframe. Practice should be designed to restrict degrees of freedom and provide stability as required. Whilst therapists can use their hands to provide feedback and physical support, the ultimate aim is for the patient to practice independently and so configuring the environment (such as positioning against a wall) and use of external supports or devices to limit compensatory movements is ideal. Compensations can cause complications such as pain, non-use, contractures, may limit real-world arm use and are characterised by decreased movement speed, increased variability of the movement and a loss of spatial and temporal inter-joint coordination.[5,6] Their presence are often indicative of an exercise or set-up needing alteration, muscle weakness or fatigue. In addition to configuring the environment to limit unwanted compensations, patients can use technologies that provide real-time feedback on movements, can be trained to govern their own movement patterns (e.g. using mirrors), or therapists can provide feedback and manual guidance.

Active – individuals should be actively engaged in their training and not rely upon passive assistance to move whenever possible. The majority of people after stroke will have some cognitive deficits in the first weeks and months after stroke and may need demonstration and physical, graded guidance at least initially, plus simple task set-ups and clear feedback.[7,8] If possible, the environment should be arranged so that an individual with stroke can undertake training with no, or limited assistance so they can practice frequently, outside of therapist delivered sessions. Enlisting the help of others (e.g. carers) may also facilitate practice. Whilst the rehabilitation environment can initially be adapted to

enable function (for example using adapted cutlery), ultimately it should provide the spatial and temporal challenges of a real-world setting, (for example, using cutlery in a busy restaurant).

Variable– in addition to titrating difficulty to maintain challenge, the training objects and goal should be varied to provide 'flexibility' of performance (such as varying plane or speed of movement). Movements can be practiced in their entirety or in parts which enables concentration upon a difficult part of a movement before being incorporated into a whole goal-oriented movement.

Feedback – clear feedback to highlight that a movement has been successful is vital to underpin learning and continued motivation. Feedback can be provided by therapists (i.e. video and verbal feedback) during the session using a coaching approach, however attention and planning is required to ensure patients receive feedback intrinsically or environmentally when practicing outside of therapist delivered sessions. This could be provided by carers, technology (e.g. virtual reality gaming, biofeedback or sensors), or by features included in the task set-up.

Conclusions and implications for research and practice

This editorial highlights that whilst completion of many repetitions of movements is important, inclusion of the other core principles of motor learning (comprising specific, graded, variable, active practice and the provision of feedback) is also needed to elicit motor recovery after stroke. This relies upon skilled movement analysis (discussed in our first editorial) to guide therapy planning and the provision of tailored support to actively engage patients in their own rehabilitation wherever possible. These approaches can also be augmented by adjuncts recommended in the guidelines, including electrical stimulation, mental imagery and mirror box.[1]

We hope that these editorials provide occupational and physiotherapists with a succinct summary of the core principles which guide *how* the currently recommended rehabilitative interventions for motor recovery can be delivered to provide the greatest benefit for people after stroke. To ensure relevance to, and impact upon clinical practice, we recommend that future research of treatments

for motor recovery after stroke must clearly articulate the principles upon which interventions are designed and *how* interventions were delivered (e.g. by using existing resources such as the TIDieR checklist and frameworks for recovery and dose).[9,10] This clarity empowers therapists to accurately utilise effective interventions in clinical practice to provide the most favourable outcomes for the many thousands of people who require rehabilitation after stroke.

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