Improving outcomes for the upper limb following severe stroke: the efficacy of rehabilitation interventions based on the Bobath concept – a randomised controlled trial

Case Study 1: Primary problem - postural control



MR K is a 52 year old man who suffered a cardio embolic right (R) middle cerebral artery stroke with haemorrhagic transformation requiring craniotomy in December 2011. This was complicated by ventricular tachycardia requiring readmission to intensive care and epileptic seizures. On admission to rehabilitation in March, he had minimal movement in the left (L) side, was unable to sit alone and could not be placed in standing due to lack of postural extension, fear of falling and L hip pain. The interventions described in this case study began five weeks post admission.

Assessment

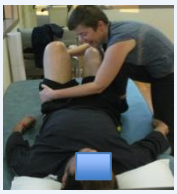


The figure shows his habitual sitting posture, with posterior pelvic tilt (PPT), trunk flexion (FL) and lateral flexion (LF) to the R and apparent outward rotation of the L leg. He was unable to be facilitated into anterior pelvic tilt (APT) (see figure), primarily because of the alignment of the L hip blocking movement of the pelvis and the flexor fixation on the R side. In supine, he was unable to rest the L leg on the bed and required two pillows to accommodate the L hip FL and outward rotation. Attempts to move the L leg from this position were usually painful. The L glenohumeral joint (GH) was held in adduction/internal rotation (ADD/IR) with increased flexor tone in the wrist and hand. He was able to participate in active assisted movements of the shoulder and elbow in all planes, however, he was unable to initiate movement of the arm and had pain on external rotation (ER) of the GH joint. He had no active control of the wrist and hand. Sensation in the L upper limb (UL) was generally intact.

Clinical reasoning

Mr K demonstrated some return of selective control proximally in the L UL, but had very poor postural control as a background for limb movement. The postural control, in turn, was limited by the poor alignment and minimal range of movement (ROM) with pain, of the L hip. In the Bobath concept, the role of postural control for the production of co-ordinated sequences of selective movement is a key focus for interventions to improve UL control1,2. This includes the production of anticipatory postural adjustments to provide dynamic stability for movement. Optimising the alignment of body segments to enhance postural control is also a major area of focus. For Mr K, it was not possible to create appropriate postural activity as a background for UL movement in any posture. All attempts at UL movement were accompanied by flexor fixation through the R side, with backward rotation of the L side and FL/ADD of the L hip. Therefore, interventions to improve UL control commenced with improving the alignment of the L hip and the flexor overactivity on the R side, to allow facilitation of appropriate postural activity in each posture utilised. This theme continued through the six treatment sessions provided over a three week period.

Intervention - Improving the alignment and active control of the L hip and pelvis





The initial goal was to reduce L hip pain and improve thorax/ pelvis/ femoral alignment. This was achieved by facilitated lengthening of trunk LF's on the R, and backward rotators of the pelvis on the L to realign pelvis and thorax. The rotation of the L femoral head in the acetabulum was explored to in all planes. This was incorporated into active movement of the L hip under Mr K's control and then into rolling on the R side.

Intervention - Activation of the L upper quadrant in rolling







With improved alignment, ROM and compliance of trunk and hip musculature, rolling was achieved from a quarter turn from supine by first facilitating backward rotation of the upper quadrant (the easier direction – requiring rotation within the spine and ribcage, scapular ADD, humeral extension and ER) then Mr K was able to initiate rolling forward through the upper quadrant, with and without elbow extension. Note the used of the wrist and hand contact points to facilitate commencement of movement.

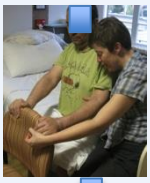
Intervention - Alignment and activation of wrist extension & metacarpal stabilisation

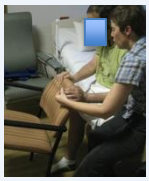


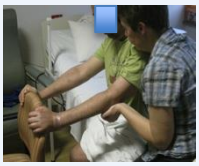


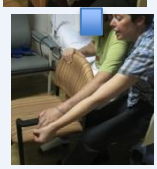
A focus on the wrist and hand was introduced early in treatment, to enable facilitation of hand initiated reach. The first figure shows re- alignment of the wrist and hand towards wrist extension and metacarpo-phalangeal FL for postural stabilisation of the hand2. On the basis of this alignment, facilitation of active finger extension and thumb movement were explored. Mr K was able to participate in activation of lumbrical muscles and wrist supination/pronation but not other distal musculature at this stage. This intervention resolved the flexor overactivity in the wrist and hand in the short term, to allow improved involvement of the hand in further treatment.

Intervention – Activation of scapulohumeral movement against gravity, with elbow extension





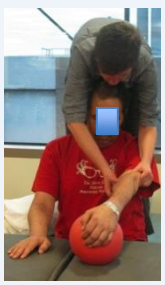




Note first that the sitting posture is much improved, with some APT and an upright thorax, as a result of the earlier treatment and a facilitated transition from lying to sitting. The scapula could be facilitated to protract, with a (limited) ability to ER the humeral head and elevate the arm to place the hand on the chair with wrist extension. The GH joint is then extended, against a stable scapula and thorax to bring the chair closer and then the elbow is extended, with GH FL to take the chair away, followed by shoulder protraction. This was followed by self initiated sliding of the hand along the arm of the chair

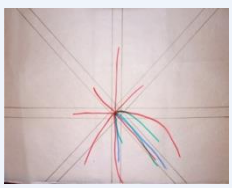
Intervention – Facilitated directional control of an object





Improved postural control for UL control was also achieved by facilitating sit to stand and stand to sit – aiming to optimise alignment of body segments and anti gravity activity, ie maximise selective extension and minimise flexor fixation strategies. Objects such as balls allowed Mr K to explore his ability to control the limb in space. Facilitation here is focusing on fractionation of elbow movement to improve selective control.

Outcome of the interventions



29/3/12
19/4/12
10/5/12



The outcome of these interventions is indicated by the results of the Pre FULT test developed for this study. This test requires the person to move a computer mouse between lines. The blue and green lines demonstrate Mr K's ability before and after his participation in the control arm of the study. The red line indicates his ability after completing the intervention arm of the study, indicating an improvement in his ability to control his L UL

References

Graham, J, Eustace C, Brock K, Swain E, Irwin-Carruthers S. (2009) The Bobath concept in contemporary clinical practice. *Top Stroke Rehabil* 16:57-68

Raine S, Meadows L, Lynch Ellerington E. *Bobath Concept: Theory and Clinical Practice*. Wiley 2009