

One Hand Clapping

Commentary on ‘Relationship between kinematic motion abnormalities and bimanual performance in children with unilateral cerebral palsy’ by Florence Gaillard et_al

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Word count (main body): 600

Number of Tables: 0

Number of Figures: 0

Children with unilateral cerebral palsy (UCP) often struggle with bimanual tasks, with adverse implications for activities of daily living and potentially for quality of life. Understanding the factors limiting bimanual performance would hopefully help practitioners optimise and target interventions for this group of children. However, accessing the blueprint for bimanual motor control mechanisms is far from straightforward. Neurophysiological and neuroimaging approaches are expensive and challenging in young children. Whilst non-invasive, observational approaches are appealing, parallels can be drawn between interpreting such studies and the presumptive state of mind of a novice Zen monk presented with his first koan. One starts by considering to what extent performance in unimanual and bimanual tasks is limited by biomechanical constraints and neurological control of the more-affected limb. Gaillard et al.¹ showed using three-dimensional movement analysis that deviations from typical movement trajectories in the more-affected upper limb (particularly in distal segments) in children with UCP are related to the performance of the more-affected hand in bimanual tasks as measured using the Assisting Hand Assessment (AHA). This is a highly plausible finding.

How though is bimanual function further impacted by damage to neural structures involved in bimanual motor control and planning – indeed, how might the development of function in such areas, even if spared from direct damage from the initial insult, be different in UCP, contributing to bimanual deficits? Furthermore, children with UCP often have subtle unimanual deficits on the “unaffected” side. It would therefore seem logical to assess the contribution of unimanual function on each side (rather than just the more-affected side) to bimanual coordination. We recently used this approach with a timed dexterity test, showing that children with UCP have bimanual deficits beyond those explained by their individual unimanual deficits². However, the act of introducing a bimanual task affects the function of both hands, creating a problem reminiscent of the “sound of one hand clapping” koan. When engaging in bimanual tasks, the less-affected hand and arm may function apparently less well than during unimanual tasks³ – but is this always maladaptive (due for example to central deficits impacting bimanual coordination) or sometimes adaptive (e.g. deliberate slowing down to match the speed of the more-affected hand)⁴? Careful thought is required in designing studies which can answer these questions.

Beyond these issues we must acknowledge the impact of other factors including corticospinal tract reorganisation, mirror movements, tactile function, inattention/neglect, visual processing deficits, cognition, postural control and seating, practice, motivation, age and personal choice (perhaps due to pain or even self-consciousness or habit) on bimanual movement performance in any individual⁵. Whilst meticulous study design and consideration of inclusion and exclusion criteria can address some of these issues, I would also question whether bimanual performance is the most robust measure when attempting to assess motor control. Assessments such as the AHA or its new counterpart the Both Hands Assessment (BoHA) evaluate spontaneous hand use during play-based settings. These assessments are optimal for evaluating bimanual performance relevant to everyday functioning (though the AHA specifically assesses the function only of the more-affected hand in UCP). However, they are more influenced by factors such as personal choice than more rigid, directed assessments. Another line of investigation, as Gaillard et al. suggest, would be to develop a 3D kinematic analysis protocol allowing a comparison of unimanual and bimanual function¹.

Specifically, it would be valuable to know to what extent therapeutic input influences unimanual and bimanual function and indeed the relationship between the two. The impact of the nature of therapy (constraint versus bimanual) on these parameters would also be of interest. It becomes clear that our journey to enlightenment has only just begun.

Acknowledgement

Dr Anna Basu is funded through a National Institute of Health Research Career Development Fellowship. The views expressed in this publication are those of the author and not necessarily those of the NHS, the National Institute for Health Research, or the Department of Health. Thanks to Professor Eyre for erstwhile philosophical discussions along these trains of thought.

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