



Modified Constraint-Induced Movement Therapy combined with Bimanual Training (mCIMT–BiT) in children with unilateral spastic cerebral palsy: How are improvements in arm-hand use established?

Pauline B. Aarts^{a,b,*}, Peter H. Jongerius^a, Yvonne A. Geerdink^a,
Jacques van Limbeek^b, Alexander C. Geurts^{b,c}

^a Sint Maartenskliniek, Department of Paediatric Rehabilitation, Nijmegen, The Netherlands

^b Sint Maartenskliniek, Department of Research, Development and Education, Hengstdal 3, 6522 JV Nijmegen, The Netherlands

^c Radboud University Nijmegen Medical Centre, Department of Rehabilitation, Nijmegen, The Netherlands

ARTICLE INFO

Article history:

Received 24 September 2010

Received in revised form 30 September 2010

Accepted 7 October 2010

Keywords:

Randomised controlled trial (RCT)

modified Constraint-Induced Movement

Therapy (mCIMT)

Cerebral palsy

Video Observations Aarts and Aarts (VOAA)

Developmental disregard

Bimanual training

ABSTRACT

A recent randomized controlled trial indicated that modified Constraint-Induced Movement Therapy followed by Bimanual Training (mCIMT–BiT) is an effective intervention to improve spontaneous use of the affected upper limb in children with unilateral spastic cerebral palsy (CP). The present study aimed to investigate how the above-mentioned improvements as a result of 8 weeks mCIMT–BiT were established. 52 children with unilateral spastic CP with Manual Ability Classification System (MACS) scores I, II or III and aged 2.5–8 years were randomly allocated to either mCIMT–BiT ($n=28$) or Usual Care (UC) ($n=24$). Developmental disregard ('learned non-use') and upper limb capacity and performance scores were derived from the Video Observations Aarts and Aarts, module Determine Developmental Disregard. Active and passive range of motion at the affected wrist and elbow were assessed using goniometry during isolated movements. Upper limb capacity and performance demonstrated significantly greater improvements after mCIMT–BiT compared to UC, which lasted up to 8 weeks follow-up, whereas developmental disregard and passive and active range of motion did not show differential effects. The results support the notion that improvement of capacity and performance of the upper limb through mCIMT–BiT in children with unilateral spastic CP is based on a better utilization of existing motor functions of the affected arm and hand. However, enhancement of the overall amount of use (or the reduction of learned non-use) may still be suboptimal leaving room for improvement of this treatment.

© 2010 Elsevier Ltd. All rights reserved.

1. Introduction

In children with unilateral spastic CP, an increasing number of studies has indicated positive effects of (modified) Constraint-Induced Movement Therapy ((m)CIMT) on the potential of the affected arm to assist the unaffected arm during bimanual activities (Eliasson, Krumlinde-sundholm, Shaw, & Wang, 2005; Wallen, Ziviani, Herbert, Evans, & Novak, 2008) as well as on the quality, speed, and dexterity of upper limb function (Bonnier, Eliasson, & Krumlinde-

* Corresponding author at: Sint Maartenskliniek, Department of Research, Development and Education, Hengstdal 3, 6522 JV, Nijmegen, The Netherlands. Tel.: +31 24 36 59 427.

E-mail addresses: p.aarts@maartenskliniek.nl, paulinearts@hetnet.nl (P.B. Aarts).

sundholm, 2006; Charles, Wolf, Schneider, & Gordon, 2006; Crocker, MacKay-Lyons, & McDonnell, 1997; Deluca, Echols, Law, & Ramey, 2006; Naylor & Bower, 2005; Sung et al., 2005; Taub, Ramey, DeLuca, & Echols, 2004; Wallen et al., 2008; Willis, Morello, Davie, Rice, & Bennett, 2002), the spontaneous use of the affected arm (Charles et al., 2006; Crocker et al., 1997; Taub et al., 2004), and the level of independence in self care (Brandao, Mancini, Vaz, de Melo, & Fonseca, 2010; Charles et al., 2006; Deluca et al., 2006; Sung et al., 2005; Taub et al., 2004; Wallen et al., 2008; Willis et al., 2002). Nonetheless, a recent Cochrane review (Hoare, Imms, Carey, & Wasiak, 2007a) concluded that, although these results are encouraging, they are still inconclusive due to methodological limitations related to small sample sizes, group allocation bias, and the influence of non specific (mainly intensity) effects. It was recommended that the effectiveness of (m)CIMT should be revealed in future, sufficiently powered trials using uniform, objective and valid outcome measures.

Recently, we conducted a randomized controlled trial (RCT) (Aarts, Jongerius, Geerdink, van Limbeek, & Geurts, 2010) in 52 children with unilateral spastic CP showing that 6 weeks mCIMT followed by 2 weeks of task-specific bimanual training (mCIMT-BiT) improves the spontaneous use of the affected limb during play and self-care activities as assessed with the Assisting Hand Assessment (AHA) (Krumlind-sundholm, Holmefur, & Eliasson, 2007) and the ABILHAND-Kids (Arnould, Penta, Renders, & Thonnard, 2004), respectively. In addition, significant improvements were obtained in terms of experienced daily life problems and individually tailored functional goals as assessed with the Canadian Occupational Performance Measure (Law et al., 2005) and Goal Attainment Scaling (Steenbeek, Ketelaar, Galama, & Gorter, 2007). Apparently, children receiving 8 weeks mCIMT-BiT improved the spontaneous use of their affected hand in most areas of daily functioning. From a neurophysiological perspective, this result imposes the question how these improvements were established? For instance, did these children improve the underlying active range of motion (aROM) or passive range of motion (pROM) at critical joints as measures at the 'bodily functions' level of the International Classification of Functioning Disability and Health (ICF) (World Health Organisation, 2010)? Or did they improve their upper limb capacity leading to better spontaneous use at the 'activity level' of the ICF, without true restoration of underlying motor functions? There is also the possibility that the children's upper limb capacity essentially remained the same, but that those receiving mCIMT-BiT improved the amount of use of the upper limb due to a reduction of so-called 'learned non-use' or 'developmental disregard'.

The notion of a reduction of learned non-use has probably received the greatest attention in the literature on mCIMT in children with CP, but it has never been established with good empirical evidence (Brady & Garcia, 2009; Hoare et al., 2007a; Hoare, Wasiak, Imms, & Carey, 2007b; Huang, Fetters, Hale, & McBride, 2009). Children with unilateral spastic CP often display a form of learned non-use, as in daily life they experience too little incentive to use their affected upper limb during functional tasks, which often becomes apparent during bilateral activities (Gordon, Charles, & Wolf, 2005). The basic notion behind learned non-use following unilateral brain damage is that certain residual motor capacities of the affected extremity remain hidden due to a learning process favouring the easier movements with the non affected extremity (Taub, Uswatte, & Pidikiti, 1999). As a result, motor performance is often better during forced activities than during spontaneous activities of the affected upper limb (Taub, Uswatte, Mark, & Morris, 2006). In the paediatric literature, this phenomenon has been referred to as 'developmental disregard', because the learned non-use does not so much relate to a relatively short period of adaptation to an acute lesion (such as in stroke), but rather reflects a developmental process or strategy through which children with unilateral CP fail to integrate the potentials of their affected upper limb in daily life routines (DeLuca et al., 2006; Hoare et al., 2007b; Sutcliffe, Logan, & Fehlings, 2009; Taub et al., 2004). In children with unilateral spastic CP, there may be a critical lack of movement stimulation during developmental periods when movement repertoires are rapidly being acquired in typically developing children. This creates a situation in which, in theory, new neural substrates for entire classes of behaviour are not well established, refined, and coordinated (DeLuca et al., 2006). In addition to this lack of movement stimulation, children with unilateral CP often suffer from upper limb spasticity and loss of motor selectivity, leading to stereotypical movement patterns such as internal rotation of the shoulder, elbow flexion with pronation of the forearm, ulnar deviation and flexion of the wrist and thumb-in-palm and/or finger-swan neck deformities (Burtner et al., 2008). These children often tend to maintain the wrist in flexion and show difficulties in extending this joint during manual activities, even when they are able to actively extend the wrist and fingers at least 30 degrees from the resting position (Vaz et al., 2008). As a result, the wrist flexors and extensors may show tissue remodelling to generate more grip strength with the wrist in flexion (Vaz, Cotta, Fonseca, Vieira, & de Melo Pertence, 2006), after which a normal movement pattern of the hand is unlikely to return and children may become prone to develop developmental disregard.

The goal of this study was to investigate *how* the above-mentioned improvements in spontaneous use of the affected limb during play and self-care activities were established as a result of 8 weeks mCIMT-BiT. Developmental disregard was assessed with the Video Observations Aarts and Aarts module Determine Developmental Disregard (VOAA-DDD) (Aarts, Jongerius, Geerdink, & Geurts, 2009) as were upper limb capacity and performance as measures at the activity level of the ICF. Indeed, recent research has shown that both unimanual capacity and bimanual performance are important aspects of bimanual activities in children with CP (Sakzewski, Ziviani, & Boyd, 2010). In addition, active and passive range of (extension) motion of the affected wrist and elbow were assessed as measures at the ICF level of bodily functions. The results of a previous study (Sutcliffe et al., 2009) led us to the hypothesis that developmental disregard would be reduced or even resolved after mCIMT-BiT. In addition, it was hypothesized that changes in active or passive range of joint motion would not underlie the improvements found at the activity level.

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات