

Early, **evidence-based** intervention matters.

Intensity matters, regardless of the intervention.

Caregiver/ parent collaboration drives the intensity.

Realistic, **functional goals** set & delivered by caregivers make this possible.

Stellar Goals^{4,15}

- Set by the parents
- Written down
- Action-oriented (**Functional**)^{10-13 3-5,8,14}
- Concrete & Observable
- Realistic time frame
- Focus on small, achievable steps
- Celebrate success before starting the next goal
- Pro tip: encourage the parent to keep a diary of the child's developmental milestones to watch their progress

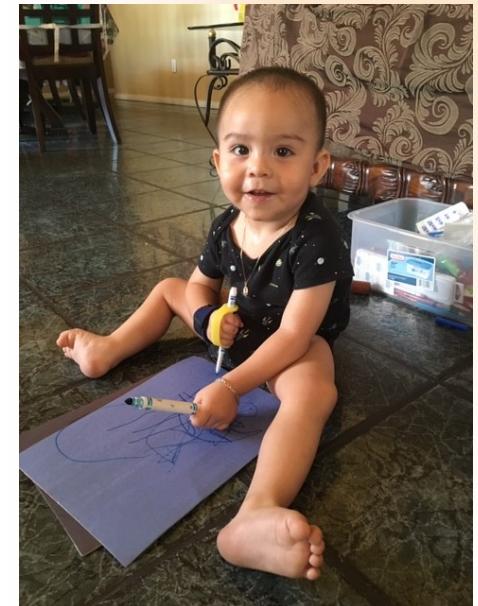


Bibliography

Research done by Hannah Mullaney, SPT and Marybeth Barkocy, PT, DPT, PCS

1. Chen Y, Pope S, Tyler D, Warren GL. Effectiveness of constraint-induced movement therapy on upper-extremity function in children with cerebral palsy: a systematic review and meta-analysis of randomized controlled trials. *Clin Rehabil*. 2014;28(10):939-953. doi:10.1177/0269215514544982
2. Morgan C, Novak I, Dale RC, Badawi N. Optimising motor learning in infants at high risk of cerebral palsy: a pilot study. *BMC Pediatr*. 2015;15(1):30. doi:10.1186/s12887-015-0347-2
3. MEDINA-MIRAFLEX F, LILLO-NAVARRO C, MONTILLA-HERRADOR I, GACTO-SÁNCHEZ M, FRANCO-SIERRA MÁ, ESCOLAR-REINA P. Predictors of parents' adherence to home exercise programs for children with developmental disabilities, regarding both exercise frequency and duration: a survey design. *Eur J Phys Rehabil Med*. 2017;(4). doi:10.23736/s1973-9087.17.04464-1
4. Øien I, Fallang B, Østensen S. Goal-setting in paediatric rehabilitation: perceptions of parents and professional: Parents' perceptions of goal-setting. *Child Care Health Dev*. 2010;36(4):558-565. doi:10.1111/j.1365-2214.2009.01038.x
5. Law M, Darrah J, Pollock N, et al. Focus on Function – a randomized controlled trial comparing two rehabilitation interventions for young children with cerebral palsy. *BMC Pediatr*. 2007;7(1):31. doi:10.1186/1471-2431-7-31
6. Dirks T, Hadders-Algra M. The role of the family in intervention of infants at high risk of cerebral palsy: a systematic analysis. Review. *Dev Med Child Neurol*. 2011;53:62-67. doi:10.1111/j.1469-8749.2011.04067.x
7. Festante F, Antowill C, Chona O, Corsi G, Guzzetta A. Parent-Infant Interaction during the First Year of Life in Infants at High Risk for Cerebral Palsy: A Systematic Review of the Literature. *Neural Plasticity*. doi:10.1155/2015/5759694
8. Chiarello LA, Bartlett DJ, Palisano RJ, et al. Determinants of participation in family and recreational activities of young children with cerebral palsy. *Disabil Rehabil*. 2016;38(25):2455-2468. doi:10.3109/09638288.2016.1138548
9. Barfoot J, Meredith P, Ziviani J, Whittingham K. Parent-child interactions and children with cerebral palsy: An exploratory study investigating emotional availability, functional ability, and parent distress. *Child Care Health Dev*. 2017;43(6):812-822. doi:10.1111/cch.12493
10. Morgan C, Darrah J, Gordon AM, et al. Effectiveness of motor interventions in infants with cerebral palsy: a systematic review. *Dev Med Child Neurol*. 2016;58(9):900-909. doi:10.1111/dmnc.13105
11. Eliasson A-C, Nordstrand L, Ek L, et al. The effectiveness of Baby-CIMT in infants younger than 12 months with clinical signs of unilateral-cerebral palsy: an explorative study with randomized design. *Res Dev Disabil*. 2018;72:191-201. doi:10.1016/j.ridd.2017.11.006
12. Basu AP, Pearce J, Kelly S, Wisner V, Kisler J. Early intervention to improve Hand Function in Hemiplegic Cerebral Palsy. *Front Neurol*. 2015;5. doi:10.3389/fneur.2014.00281
13. Harbourne R, Kamm K. Upper extremity function: What's posture got to do with it? *J Hand Ther*. 2015;28(2):106-113. doi:10.1016/j.jht.2015.01.008
14. Law MC, Darrah J, Pollock N, et al. Focus on function: a cluster, randomized controlled trial comparing child-versus context-focused intervention for young children with cerebral palsy: Child- or Context-Focused intervention for CP. *Dev Med Child Neurol*. 2011;53(7):621-629. doi:10.1111/j.1469-8749.2011.03962.x
15. Singhi P. The child with Cerebral Palsy-clinical considerations and management. *Indian J Pediatr*. 2001;68(6):531-537. doi:10.1007/BF02723248
16. Hadders-Algra M, Bouw AG, Hielsma T, Hamer EG. Effect of early intervention in infants at very high risk of cerebral palsy: a systematic review. *Dev Med Child Neurol*. 2017;59(3):246-258. doi:10.1111/dmnc.13331
17. Morgan C, Novak I, Badawi N. Enriched environments and motor outcomes in cerebral palsy: systematic review and meta-analysis. *Pediatrics*. 2013;132(3):e735-746. doi:10.1542/peds.2012-3985
18. Taub E, Griffin A, Nick J, Gammons K, Uswatte G, Law CR. Pediatric CT therapy for stroke-induced hemiparesis in young children. *Dev Neurorehabilitation*. 2007;10(1):3-18.
19. Wallen M, Ziviani J, Taylor O, Evans R, Novak I, Herbert RD. Modified constraint-induced therapy for children with hemiplegic cerebral palsy: a randomized trial. Modified Constraint-Induced Therapy in CP. *Dev Med Child Neurol*. 2011;53(12):1091-1099. doi:10.1111/j.1469-8749.2011.04086.x
20. DeLuca SC, Echols K, Ramey SL, Taub E. Pediatric constraint-induced movement therapy for a young child with cerebral palsy: two episodes of care. *Phys Ther*. 2003;83(11):1003-1013.
21. Hoare B, Imms C, Villanueva E, Rawicki HB, Matyas T, Carey L. Intensive therapy following upper limb botulinum toxin A injection in young children with unilateral cerebral palsy: a randomized trial. *Dev Med Child Neurol*. 2013;55(3):238-247. doi:10.1111/dmnc.12054
22. Chamudot R, Parush S, Righi A, Horowitz R, Gross-Tsur V. Effectiveness of Modified Constraint-Induced Movement Therapy Compared With Bimanual Therapy Home Programs for Infants With Hemiplegia: A Randomized Controlled Trial. *Am J Occup Ther*. 2018;72(6):7206205010p1-7206205010p9. doi:10.5014/ajot.2018.025981
23. Boyd RN, Ziviani J, Sakzewski L, et al. REACH: study protocol of a randomised trial of rehabilitation very early in congenital hemiplegia. *BMC Open*. 2017;7(9):e017204. doi:10.1136/bmjopen-2017-017204
24. Reidy TG, Carney J, Whiston N, Naber E. Infant constraint induced movement therapy: Lessons learned from clinical implementation. *J Pediatr Rehabil Med*. 2017;10(1):61-67. doi:10.3233/PRM-170411
25. Kerr C, McDowell B. Electrical stimulation in cerebral palsy: a review of effects on strength and motor function. *Dev Med Child Neurol*. 2004;46(3):205-213. doi:10.1111/j.1469-8749.2004.tb00472.x
26. Sakzewski L, Ziviani J, Boyd R. Systematic Review and Meta-analysis of Therapeutic Management of Upper-Limb Dysfunction in Children With Congenital Hemiplegia. *PEDIATRICS*. 2009;123(6):e1111-e1122. doi:10.1542/peds.2008-3335
27. Jackman M, Novak I, Lannin N. Effectiveness of hand splints in children with cerebral palsy: a systematic review with meta-analysis. *Dev Med Child Neurol*. 2014;56(2):138-147. doi:10.1111/dmnc.12205
28. Krumlinde-Sundholm L, Holmér M, Kottorp A, Eliasson A-C. The Assisting Hand Assessment: current evidence of validity, reliability, and responsiveness to change. *Dev Med Child Neurol*. 2007;49(4):259-264. doi:10.1111/j.1469-8749.2007.02059.x
29. Lannin NA, Ada L. Neurorehabilitation splinting: theory and principles of clinical use. *NeuroRehabilitation*. 2011;28(1):21-28. doi:10.3233/NRE-2011-0628
30. Elliott CM, Reid SL, Alderson JA, Elliott BC. Lycra arm splints in conjunction with goal-directed training can improve movement in children with cerebral palsy. *NeuroRehabilitation*. 2011;28(1):47-54. doi:10.3233/NRE-2011-0631
31. Louwers A, Meester-Delver A, Folmer K, Nollet F, Beelen A. Immediate effect of a wrist and thumb brace on bimanual activities in children with hemiplegic cerebral palsy. *Dev Med Child Neurol*. 2011;53(4):321-326. doi:10.1111/j.1469-8749.2010.03849.x
32. Jackman M, Novak I, Lannin N. Effectiveness of functional hand splinting and the cognitive orientation to occupational performance (CO-OP) approach in children with cerebral palsy and brain injury: two randomised controlled trial protocols. *BMC Neurol*. 2014;14:144. doi:10.1186/1471-2377-14-144
33. Currie DM, Mendis A, Carroll thumb orthosis for children with spastic hemiplegic cerebral palsy. *Arch Phys Med Rehabil*. 1987;68(4):214-216.
34. Ten Berge SR, Boonstra AM, Dijkstra PU, Hadders-Algra M, Haga N, Maathuis CGB. A systematic evaluation of the effect of thumb opponens splints on hand function in children with unilateral spastic cerebral palsy. *Clin Rehabil*. 2012;26(4):362-371. doi:10.1177/0269215511411936
35. Blair E, Ballintyne J, Housman S, Chauvel P. A Study of a Dynamic Proximal Stability Splint in the Management of Children with Cerebral Palsy. *Dev Med Child Neurol*. 1995;37(6):544-554. doi:10.1111/j.1469-8749.1995.tb12041.x
36. Aasmussen R. Photo of Father and Son Reading.
37. Marybeth Barkocy. All other photos of infants.

A Summary of Evidence-Based Interventions for Infants and Young Children at Risk for Unilateral Cerebral Palsy



Keeping the FUN in Functional



Evidence-Based Physical Therapy

Ideal dosing is still being investigated, but evidence shows the **intensity** matters.^{1,16,19,20} Multiple evidence-based approaches work equally as well.

Constraint-Induced Manual Therapy (CIMT)^{1,11,12,18,19,21,22}

What: unilateral therapy; unaffected arm is restrained for a limited period of time, while the child is encouraged to use their affected upper extremity. **How:** Any position, but ideal is sitting on floor or high chair with trunk support as necessary, adequate head control, eye contact with caregiver. **For example:** Finger painting, popping bubbles with one finger,¹⁸ grasping. **Types of constraints:** mitt, sock, shirt with clip, neoprene (wetsuit material), splint, short cast, long arm cast. *Reserve casting for older children.

Bimanual Therapy^{12,21,22}

What: child is encouraged to use both upper extremities symmetrically and asymmetrically to play and reach. **How:** Any position, but ideal is sitting on floor or high chair with trunk support as necessary, adequate head control, eye contact with caregiver. **For example:** Shake a pair of rattles, play the xylophone with two hands, pull beads off a stick, take blocks out of a container.

Set up for success!

Incorporate these ideas into all types of therapy. Keep it functional!

Intensity is crucial, which comes through practice at home. Therefore, caregivers need to be directly involved. Ideas from research for a successful collaboration:

Parents and caregivers are MVP!³⁻⁹

Empower the caregivers: Boost their confidence and self-efficacy. Point out progress. Follow up.

Watch for depression and refer as necessary.

Collaborate with the caregivers: watch the child move together, discuss development and impairments while watching the child together, parents help set goals, help them find opportunities to practice in their daily routine (not additional HEP).

Let parents be parents, not therapists.

Help them find ways to make movement a natural part of play, eating, and routine interactions.

Enriched Environment^{2,12,16,17,5}

Set up an environment that makes the child move and explore.

- ◆ Active approach --- encourage trial and error learning. Quality is not so important.
- ◆ Limit manual facilitation. Help as little as possible for child to achieve success.¹⁸
- ◆ Frequent, variable, and customized task practice
- ◆ Age-appropriate and engaging
- ◆ Compensatory strategies can be okay
- ◆ Teach the parent how to set up this environment

Evidence-Based Physical Therapy, continued

Home program dosing suggestion for CIMT and bimanual therapy.^{11,23}

Combining CIMT and bimanual therapy is possible and practical in practice²⁴

20 min/day, 5 days a week for infants 3-6 mo²³
40 min/day, 5 days a week for infants 9-12 mo²³
30 min/day, 6 days a week, for 12 weeks¹¹

NMES²⁵

Electrical stimulation of extensors and dorsiflexors (glutes, quads, anterior tibialis; triceps, wrist extensors, extensor digitorum) as well as finger and wrist flexors.

Frequencies generally 30-45Hz, pulse duration 100-300 μ sec, ramp up time 0.5-2 sec.

Applied for 15-20 min in task-oriented therapy setting for 1 hour for 2 months at home.

Botulinum toxin A injection with therapy^{21,26}

A study with children >18 months showed that botulinum toxin A injections combined with CIMT or bimanual therapy was effective.

Hand splints/ orthoses^{12,26,27,27-35}

There are functional and non-functional hand splints. Evidence for non-functional orthoses, which are used for short periods of time (including at night), is limited^{27,29}. There is a lack of research for infants <18mo.

Incorporated into routine interactions

