Specific Care Question :
Is CIMT therapy more effective in developing fine motor skills in children with hemi-paresis than traditional therapies?

Is CIMT group therapy more effective in developing fine motor skills in children with hemi-paresis than individual CIMT?

Question Originator:
Andrea Melanson OTD, OTR/L

Plain Language Summary from The Office of Evidence Based Practice:
The included studies are all of moderate to very low quality studies. The meta-analysis performed by Hoare, Imms, Carey, and Wasniak (2007) included 4 studies. Two are randomized control trials and two are small before and after trials. The only advantage of CIMT over traditional therapy in the included study is improved scores on the Quest assessment for "Assisting Hand Assessment" post treatment and lasting out to 6 months post treatment.

Six studies were entered into Review Manager (RevMan 5.1.7). A strength of RevMan is uniform bias assessment. Across the included studies, the major bias was lack of blinding of the outcome assessor. Since the patient and the treating therapist cannot be blinded, studies of this type would be strengthened by the blinding of those who determined the scores on the various tools used to assess the treatment effect. This did not occur. A major concern of four of the included studies is children randomized to the CIMT groups were in therapy for longer periods of time than children in the control groups. It is difficult to differentiate the treatment effects of therapy time and CIMT.

Five cohort studies are summarized in a summary of findings table. The studies included here are all cohort studies, and most are of poor quality due to low number of subjects and outcome assessors are not blinded to treatment There were also many differences among the included studies. The length of time the constraint device was worn, the number of weeks of therapy, the physical space of the therapy i.e. the OT clinic for all therapy, OT clinic plus parent guided therapy, or day camp settings. Finally, many different tools were used to assess the effect of the therapy. In general, the following can be stated:

- In the study by Aarts, Jongerius, Geerdink, van Limbeek, & Geurts (2010) improvement was seen in Assisting Hand Assessment and ABILIhand inventories at 9 weeks, but was not maintained at the 17 week assessment. No difference on the Melbourne Score was noted at either 9 or 17 weeks
- Case-Smith, DeLuca, Stevenson, and Ramey (2012) found no difference in outcomes at 1 month or 6 months in children treated with 3 hours of CIMT therapy versus 6 hours of CIMT therapy per day. Although the study groups were small, this finding shows that 3 hours of therapy is efficacious as longer therapy time.
- In the study by Taub, Ramey, DeLuca, & Echols (2004) that compared CIMT versus standard therapy, the score on the

Emerging Behaviors Scale-post treatment ,and the score on PMAL-amount of arm use (both post treatment and at the three week follow-up were significantly improve in the CIMT group. Cimolin et al.(2012) reported on a pre/post CIMT therapy without comparison to standard therapy. CIMT did improve movement duration, movement smoothness and precision index, adjusting sway. Although ROM shoulder flex extension did not show improvement with CIMT, ROM shoulder abduction/adduction and elbow flex extension did show significant improvement after CIMT therapy. The other included studies compared CIMT and standard therapies, and showed no difference between the two.

Based on very-low to moderate quality evidence a weak recommendation is made to use CIMT in the treatment of children with hemiplegia. Desirable effects are similar to other intensive therapies for hemiplegia in children with cerebral palsy. There is evidence for improvement in ability, though not superior to standard therapy. No harm was described in the included studies. Other alternatives may be equally reasonable. Further research (if performed) is likely to have an important influence on our confidence in the estimate of effect and is likely to change the estimate.

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Search Strategy and Results:
"Restraint, Physical"[Mesh] AND ("Hemiplegia/physiopathology"[Mesh] OR "Hemiplegia/rehabilitation"[Mesh])

Method Used for Appraisal and Synthesis:
The Cochrane Collaborative computer program, Review Manager (RevMan 5.1.7) was used to synthesize the 6 included randomized controlled trials. The GradeProfiler (GradePro 3.6) was used to synthesize the included meta-analysis, and five studies were

synthesized using CASP tools (Solutions for Public Health, http://www.phru.nhs.uk/Pages/PHD/resources.htm) and aggregated on the Critically Appraised Topic (CAT) form.

Updated: May 28, 2013;May 30, 2013

Characteristics of included study :

Tables:

Hoare, 2007

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**In-directness**	**Im-precision**	**Other consider-tions**	**CIMT**	**Tradition therapy**	**Relative (95% CI)**	**Absolute**		
Quest "change" score dissociated movement baseline to post treatment (3wks) (measured with: QUEST assessment; Better indicated by higher values)												
1	randomized trials	serious[1,2]	no serious inconsistency	no serious indirectness	no serious imprecision	none	9	9	-	SMD 0.91 higher (0.08 lower to 1.89 higher)	XXXO MODERATE	CRITICAL
QUEST "Assisting Hand Assessment" (post treatment) (Better indicated by higher values)												
1	observational studies	serious[3,4]	no serious inconsistency	no serious indirectness	no serious imprecision	none	21	20	-	SMD 1.12 higher (0.1 to 1.37	XOOO VERY LOW	CRITICAL

										higher)		
QUEST "Assisting Hand Assessment" score (6 months) (Better indicated by higher values)												
1	observational studies	serious[3,4]	no serious inconsistency	no serious indirectness	no serious imprecision	none	21	20	-	MD 0.74 higher (0.1 to 1.37 higher)	XOOO VERY LOW	CRITICAL
WeeFIM total "change" score (follow-up 6 weeks; Better indicated by higher values)												
1	randomized trials	serious[5]	no serious inconsistency	no serious indirectness	no serious imprecision	none	18	13	-	SMD 0.40 higher (0.32 lower to 1.12 higher)	XXXO MODERATE	CRITICAL

[1] Single blinded RCT
[2] Used folded paper taped closed drawn from a jar
[3] Not randomized
[4] Four subjects withdrew from the treatment group
[5] Randomization and allocation concealment poorly or not described

Aarts 2010

Methods Randomized Controlled Trail

Participants Children with unilateral spastic CP were recruited from 8 rehabilitation centers in the Netherlands.

Inclusion criteria were (a) CP with a unilateral or severely asymmetric, bilateral spastic movement impairment; (b) age 2.5 to 8 years; and (c) Manual Ability Classification System (MACS)19 scores I, II, or III.

Exclusion criteria were (a) intellectual disability such that simple tasks could not be understood or

executed (ie, developmental age less than 2 years), (b) inability to combine the study protocol with the regular school program, and (c) inability to walk independently without a walking aid.

Randomized: Treatment Group N=28 and Control Group N=24.

Age (mean in years): Treatment Group 4.8± 1.3 and Control Group 5.1± 1.7

Power Analysis: 18 per group were required to obtain a power of 90% to detect at least a moderate treatment effect.

Interventions Children were randomly allocated to either

1. mCIMT-BiT group (three 3-hour sessions per week: 6 weeks of mCIMT, followed by 2 weeks of task-specific training in goal-directed bimanual play and self-care activities) **OR**

2. Usual Care (UC) group- 1.5 hours of more general physical or occupational weekly plus encouragement to use the affected hand

Before the start of the intervention period (week 0), all children underwent a comprehensive upper limb evaluation that was repeated at the end of the intervention period (week 9) and again after 8 weeks (follow-up in week 17). At the end of the study protocol (week 17),

Outcomes Primary outcome measures were the Assisting Hand Assessment and the ABILHAND-Kids. Secondary outcomes were the Melbourne Assessment of Unilateral Upper Limb Function, the Canadian Occupational Performance Measure, and the Goal Attainment Scale. Results.

Risk of bias table

Bias	Scholars' judgment	Support for judgment
Random sequence generation (selection bias)	Low risk	Each participant was randomized by throwing dice with equal probabilities.
Allocation concealment (selection bias)	Low risk	It does not appear to have allocation bias.

Blinding of participants and personnel (performance bias)	Low risk	Unable to blind participants and personnel due to the type of intervention.
Blinding of outcome assessment (detection bias)	Low risk	All assessments were completed by occupational therapists who were blind to group allocation and not involved in the study.
Incomplete outcome data (attrition bias)	Low risk	Two subjects immediately dropped out after randomization to the UC group. They are not included in the analysis in the study. However, for this project, analysis was completed with and without the subjects who dropped out. No difference in the outcome for the primary outcome was detected.
Selective reporting (reporting bias)	Low risk	All primary and secondary outcomes reported.
Other bias	High risk	They compared 9 hours/wk of intense therapy with CIMT with trained OT to 1.5/hr week of usual therapy asking parents and/or teachers to complete 7.5 hours of therapy at home each week.

Brandao 2012

Methods	RCT- sub set of a larger study. (The last 16 subjects recruited to the larger study)
Participants	16 pediatric subjects with hemiplegic cerebral palsy Mean age
Interventions	Treatment: CIMT 15 days, 6 hours daily (90 hrs) Control- HABIT 15 days, 6 hours daily (90 hrs)
Outcomes	Pediatric Evaluation of Disability Canadian Occupational Performance Measure (COPM) Both were measured before intervention and post. No follow up measure were taken
Notes	

Risk of bias table

Bias	Scholars' judgment	Support for judgment
Random sequence generation (selection bias)	Low risk	Off site, stratified by age and severity
Allocation concealment	Low risk	concealed

(selection bias)		
Blinding of participants and personnel (performance bias)	Low risk	Unable to blind participant and personnel
Blinding of outcome assessment (detection bias)	High risk	Outcome assessor was not blind to group assignment.
Incomplete outcome data (attrition bias)	Unclear risk	All subjects finished and data present
Selective reporting (reporting bias)	Unclear risk	
Other bias	Unclear risk	

Case-Smith 2012

Methods	RCT
Participants	3 sites recruited children ages 3-6yr for a total of 18 children with unilateral CP
Interventions	Experimental: 3 hours of CIMT/d for 18 days Control: : 6 hours of CIMT dl for 18 days; Both groups completed bimanual activities from day 18 to day 21. All intervention therapy occurred over 4 weeks
Outcomes	Assisting Hand Assessment (AHA) QUEST (Quality of Upper Extremity Skills Test) PMAL (Pediatric Monitor Activity Log)
Notes	**Inclusion criteria**: after screening to identify children with central nervous system lesions occurring before 1 month of age, no botox within past 6 months, no previous CIMT participation, no presence of major uncontrolled seizures or comorbid medical conditions or presence of visual impairment: the Data

Coordinating and Analysis Center (DCAC)

Risk of bias table

Bias	Scholars' judgment	Support for judgment
Random sequence generation (selection bias)	Low risk	Randomized by means of a computer-generated randomization table.
Allocation concealment (selection bias)	Low risk	The Data Coordinating and Analysis Center at one site was used to allocate
Blinding of participants and personnel (performance bias)	Low risk	Participants and therapists providing the intervention were not blinded but could not be blinded in order to carry out the CIMT protocol.
Blinding of outcome assessment (detection bias)	Low risk	Assessors were blinded to which group the children were treated
Incomplete outcome data (attrition bias)	Low risk	all data present
Selective reporting (reporting bias)	Low risk	The protocol is available and pre-specified outcomes were reported.
Other bias	Low risk	

Sakzewski 2011

Methods	RCT Single blind
Participants	Children with hemiplegia. N=64
Interventions	Experimental CIMT Control- bimanual training Buddies- convenience sample for comparison at 26 weeks
Outcomes	Primary- Canadian Occupational Performance Measure (COPM) Secondary- Assessment of live Habits (LIFE-H) Children's Assessment of Participation and Enjoyment and School Function Assessment Outcomes were assessed at 3 and 26 weeks after the program was complete

	Sample size was calculated on the primary activity outcome Melbourne Assessment of Unilateral Upper Limb Function.
Notes	Supported by the National Health and Medical Research Council of Australia Study was done in Australia

Risk of bias table

Bias	Scholars' judgment	Support for judgment
Random sequence generation (selection bias)	Low risk	Matched in pairs and then randomized within pairs. Sequence was by computer generated random numbers.
Allocation concealment (selection bias)	Low risk	concealed envelopes, created by non study personnel
Blinding of participants and personnel (performance bias)	Low risk	Although patients knew which group they were in, low ability to change results
Blinding of outcome assessment (detection bias)	Unclear risk	They could have had outcome assessors who were blinded to group allocation
Incomplete outcome data (attrition bias)	Unclear risk	They did a power analysis, needed 26 per group (52 total) to detect a 7 unit difference on the primary measure the Melbourne Assessment of Unilateral Upper Limb Function. They did not report on this test. Furthermore, they used per protocol analysis
Selective reporting (reporting bias)	High risk	Although they power their study on the Melbourne Assessment of Unilateral Upper Limb Function, they do not report any results on this test. Therefore the study is mis-powered for all outcomes reported upon. Also, they report significant P values on Table 4. The P-values are not attached to the data in Table 4. The p values are pre-post.
Other bias	Unclear risk	Both treatments significantly improved the COPM for Performance and Satisfaction. They did not differ in the magnitude of the improvement.

Taub 2004

Methods	RCT of pediatric CI therapy
Participants	• 18 children recruited from local-area early-intervention programs, health care practitioners, or self-referrals. • Diagnosis of CP resulting in hemiparesis or substantially greater deficit in movement of 1 upper extremity in comparison to the other, good health, ≤8 years old, and for children <18months an etiology of stroke confirmed by MRI.
Interventions	Children were assigned randomly to receive either pediatric CI therapy or conventional treatment. • Treatment: CI therapy included 6 hours/day for 21 consecutive days coupled with bi-valved casting of the child's less-affected upper extremity for that period. • Control: Continued with conventional therapies (PT and/or OT) for a mean of 2.2 hours per week.
Outcomes	Children receiving pediatric CI therapy compared with controls: • acquired significantly more new classes of motoric skills (9.3 vs. 2.2) • demonstrated significant gains in the mean amount (2.1 vs. 0.1) and quality (1.7 vs. 0.3) of more-affected arm use at home • in a laboratory motor function test, displayed substantial improvement including increases in unprompted use of the more-affected upper extremity (52.1% vs. 2.1% of items). Benefits were maintained over 6 months, with supplemental evidence of quality-of-life changes for many children.

Risk of bias table

Bias	Scholars' judgment	Support for judgment
Random sequence generation (selection bias)	Low risk	Randomness achieved by assigning patients according to the group designation indicated on a folded piece of paper, taped closed, and drawn from a jar set up before the beginning of subject enrollment.
Allocation concealment (selection bias)	Low risk	Folded piece of paper, taped closed and drawn from a jar set-up before the beginning of subject enrollment.
Blinding of participants and personnel (performance	High risk	• Children participants were not blinded to intervention • Personnel were not blinded to which group child was participating in.

bias)		
Blinding of outcome assessment (detection bias)	High risk	• Video tapes of the TAUT assessment were scored independently by 2 experienced pediatric occupational therapists were blind to the treatment group and pre- or post-treatment status of the children • The Emerging Behaviors Scale (EBS) and the Pediatric Motor Activity Log (PMAL) were completed by the primary caregiver, therapist, or child's previous provider of physical rehabilitation services.
Incomplete outcome data (attrition bias)	Low risk	No loss of participants throughout study.
Selective reporting (reporting bias)	Low risk	The study protocol is available The study's pre-specified outcomes have been reported.
Other bias	High risk	Description of conservative therapy not provided, only time per week provided.

Yu 2012

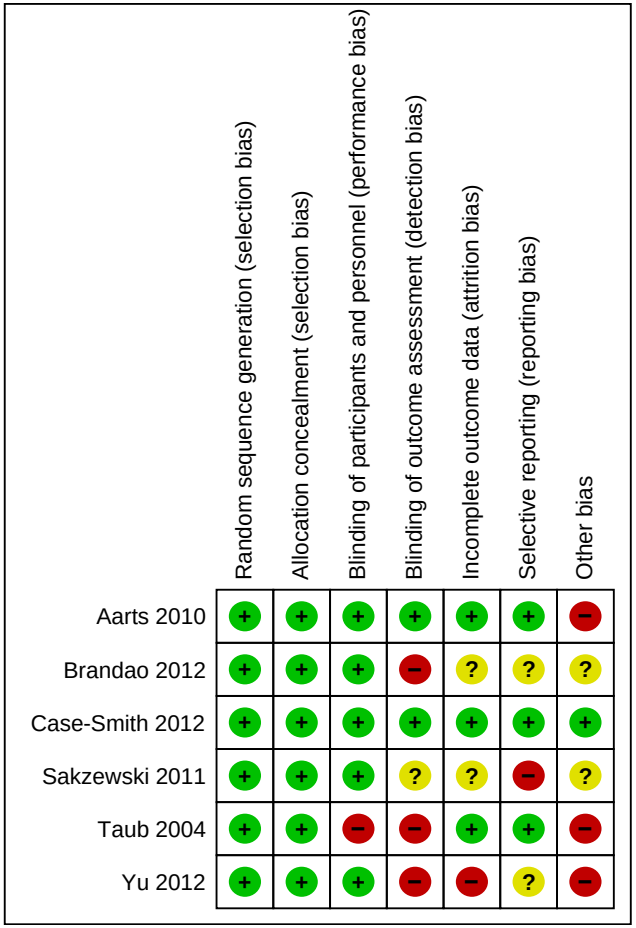
Methods	Randomized Control Trail
Participants	24 Children with hemiplegic CP. Country-Korea 2011. The subject selection criteria was 1.) no modified constraint induced movement therapy (mCIMT) in the previous 2 years 2.) voluntary movement not limited when the non-affected side is restrained 3.) No difficulties in performing passive range of motion exercises 4.) Some active ROM on the affected side and no cognitive deficits. Gender 13 males and 7 females. Average age 9.4 years. 20 children were randomized using a table of random sampling numbers. The groups were segregated from each other for a single-blind analysis.
Interventions	Treatment: (mCIMT) N=10- 60 minute sessions of mCIMT for 10 weeks plus traditional rehabilitation therapy in 30 min sessions, semi-weekly, for 10 weeks Control: traditional rehabilitation therapy in 30 min sessions, semi-weekly, for 10 weeks Twenty children with CP were allocated into mCIMT (n=10) and control (n=10) groups. . After 10 weeks the mCIMT was started for 10 weeks at 60min per session. The CON group continued traditional therapy only for 10 weeks.

Outcomes	hand function ADL evaluations
Notes	Difficult to interpret what was compared in the results. Poorly reported. Do not recommend using this study.

Risk of bias table

Bias	Scholars' judgment	Support for judgment
Random sequence generation (selection bias)	Low risk	Subjects were randomized using a table of random sampling numbers.
Allocation concealment (selection bias)	Low risk	The study was a single blind study. Everyone could not be blinded due to the type of intervention.
Blinding of participants and personnel (performance bias)	Low risk	The patients were asked not to discuss their protocol with members of the other group. Investigators were not blinded.
Blinding of outcome assessment (detection bias)	High risk	Do not state the outcome assessors were blinded.
Incomplete outcome data (attrition bias)	High risk	24 children were randomized; post tests only obtained from 20 are reported. Not certain which group had drop outs.
Selective reporting (reporting bias)	Unclear risk	Unable able to determine if there is selective reporting.
Other bias	High risk	The treatment group and the control group had different quantities of therapy each week. It is a confounder.

Figures:



A major confounder exists with the following studies: Aarts et al (2010); Case-Smith et al (2012), Taub et al (2004); and Yu, et al (2012). In each of these studies the quantity of therapy administered to the treatment group was greater than the therapy administered to the control group. It is difficult to distinguish the effect of the time spent in therapy versus the effect of constraining the functional limb.

Figure 1. Risk of bias summary. EBP Scholars' judgments about each risk of bias item for each study included in RevMan

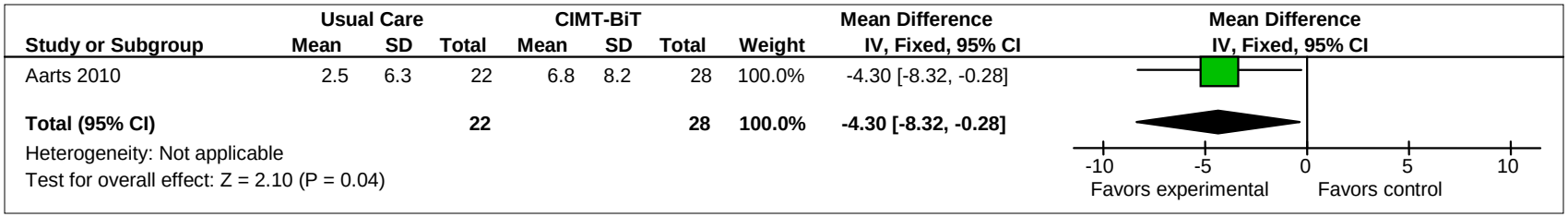


Figure 2.X. CIMT combined with bimanual training vs. usual care, Outcome: Assisting Hand Assessment at 9 weeks

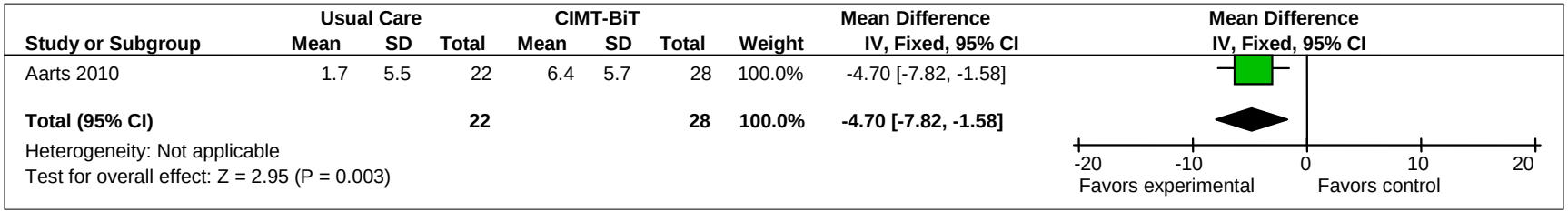


Figure 2.X. CIMT combined with bimanual training vs. usual care, Outcome: Assisting Hand Assessment at 17 weeks

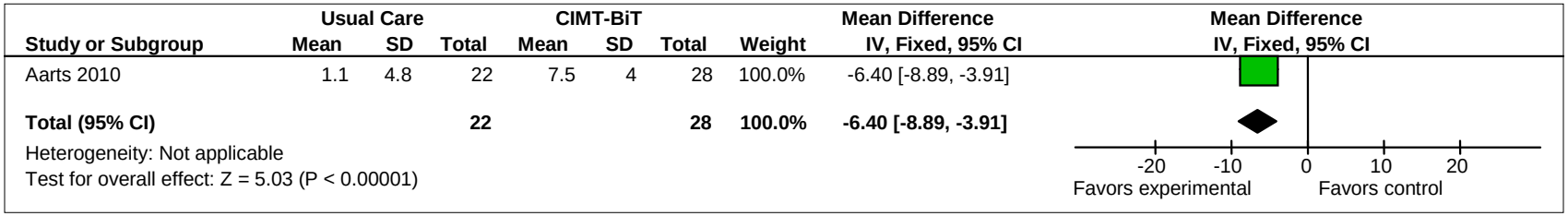


Figure 2.X. CIMT combined with bimanual training vs. usual care, Outcome:ABLI Hand at 9 weeks

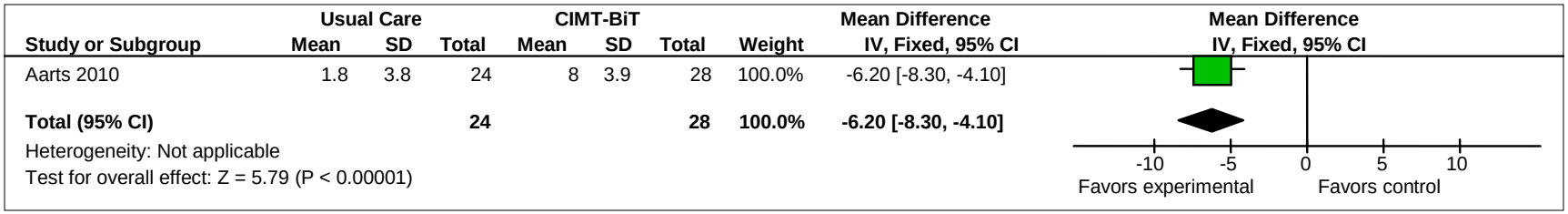


Figure 2.X. CIMT combined with bimanual training vs. usual care, Outcome:ABLI Hand at 17 weeks

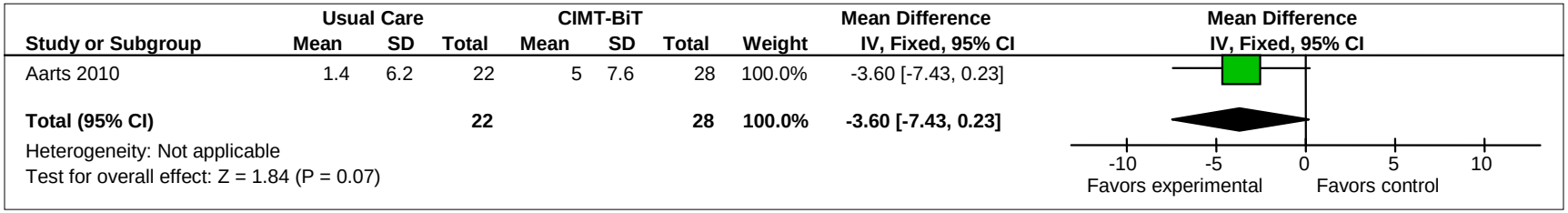


Figure 2.X. CIMT combined with bimanual training vs. usual care, Outcome: Melbourne at 9 weeks

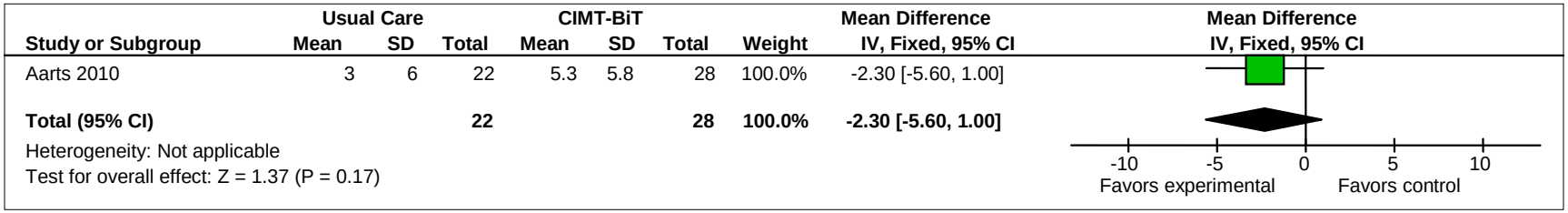


Figure 2.X. CIMT combined with bimanual training vs. usual care, Outcome: Melbourne at 17 weeks

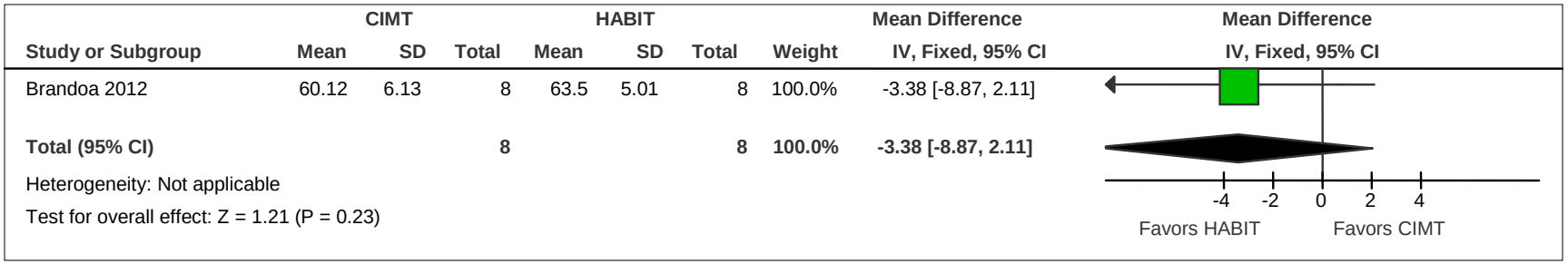


Figure 3.X. CIMT vs. HABIT Post scores, Outcome: PEDI Self-care functional skills

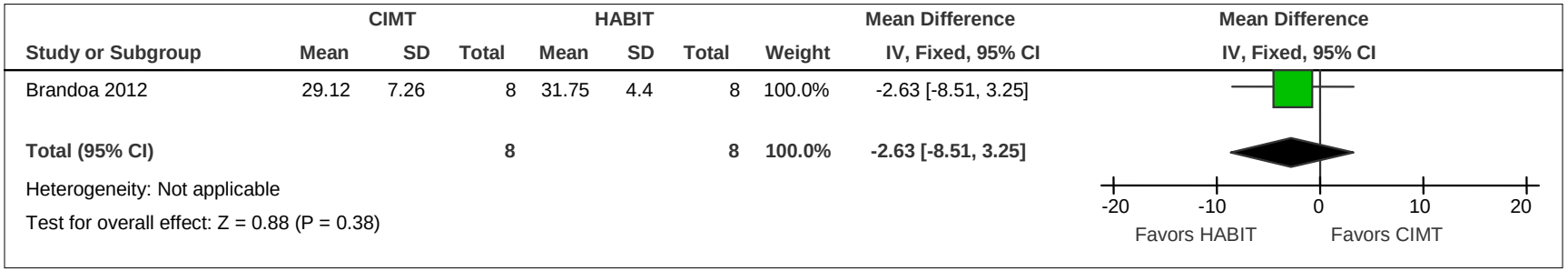


Figure 3.X. CIMT vs. HABIT Post scores, Outcome: Independence

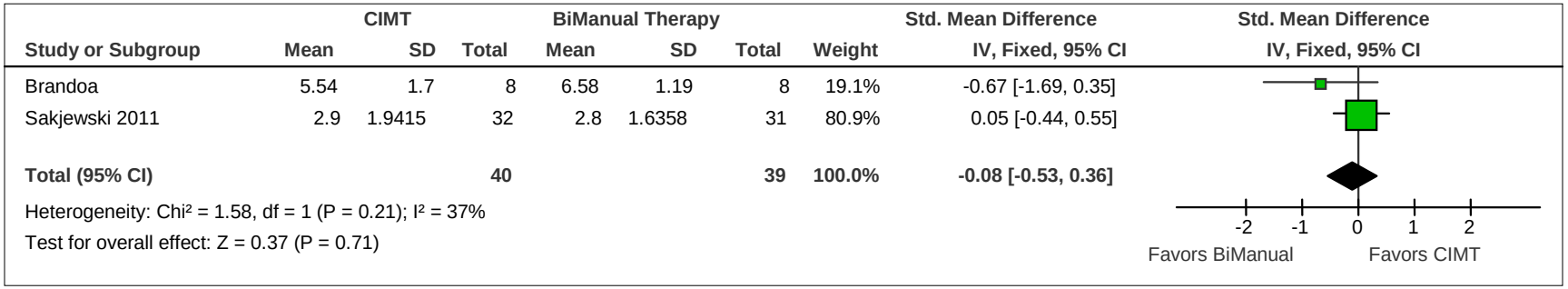


Figure 3.X. CIMT vs BiManual: Outcome: Post scores total

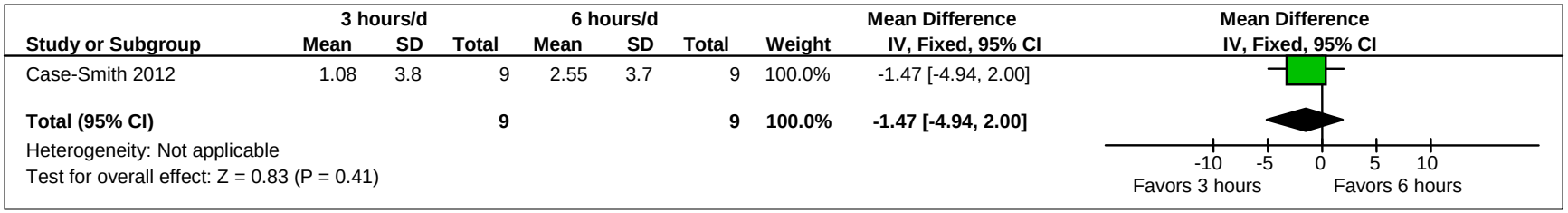


Figure 4.X. 3 hours/d vs. 6 hours/d CIMT therapy, Outcome: AHA Score at 1 month

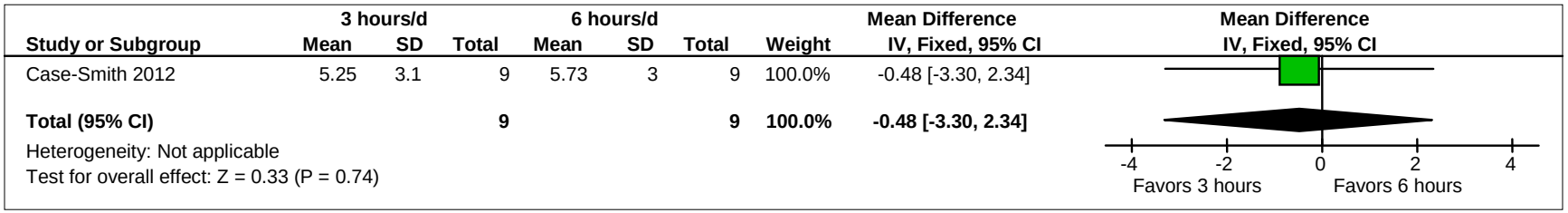


Figure 4.X. 3 hours/d vs. 6 hours/d CIMT therapy, Outcome: QUEST Score Grasp/Release

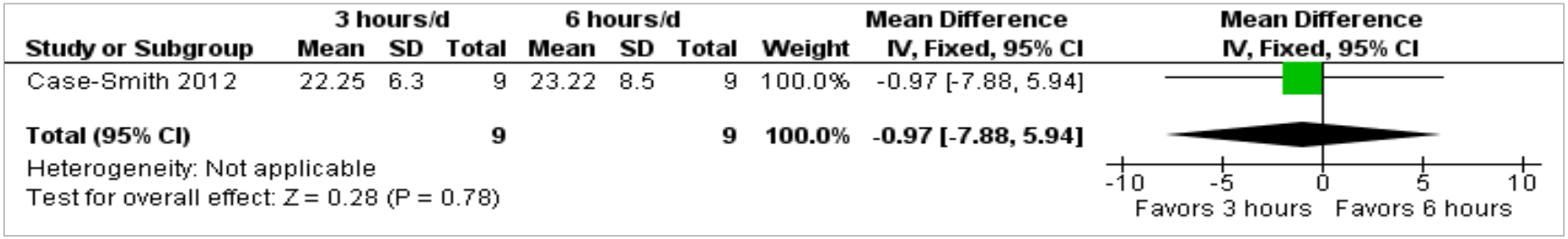


Figure 4.X. 3 hours/d vs. 6 hours/d CIMT therapy, Outcome: QUEST Score Dissociated Movement at 1 month

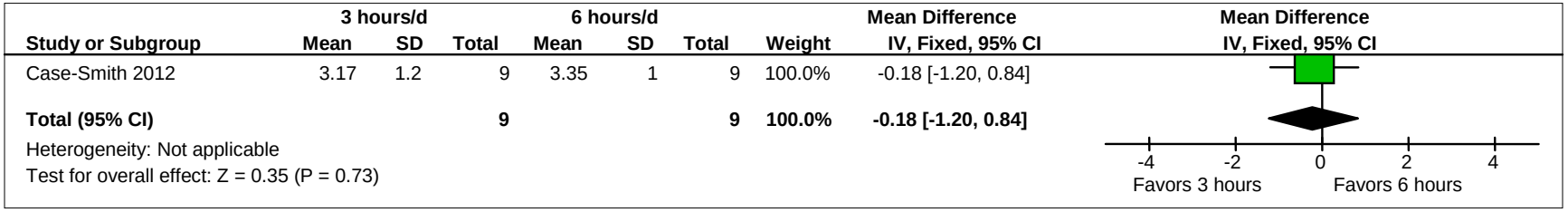


Figure 4.X. 3 hours/d vs. 6 hours/d CIMT therapy, Outcome: PMAL frequency of use at one month

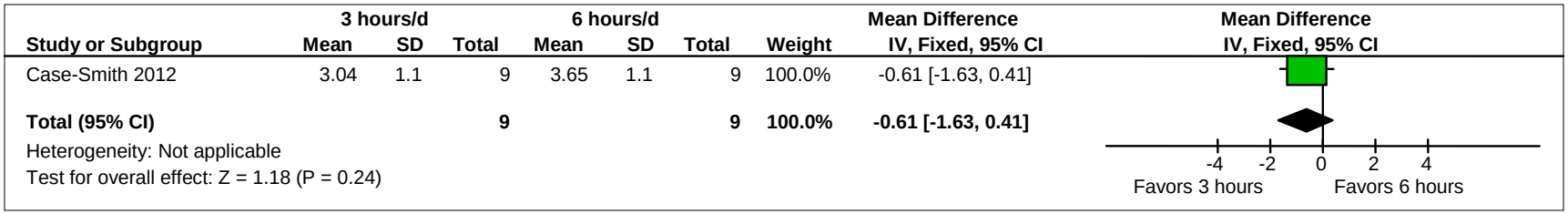


Figure 4.X. 3 hours/d vs. 6 hours/d CIMT therapy, Outcome: PMAL Quality of movement at 1 month

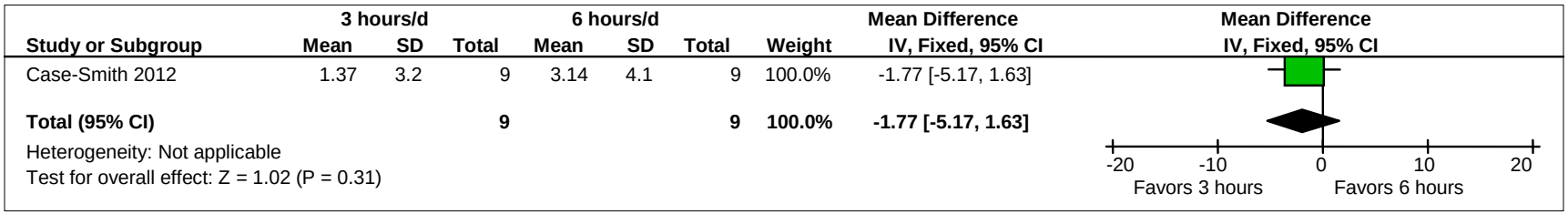


Figure 4.X. 3 hours/d vs. 6 hours/d CIMT therapy, AHA Score at 6 months

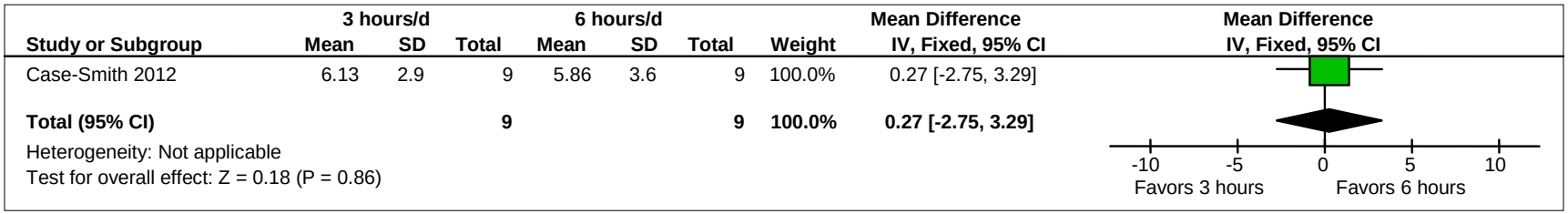


Figure 4.X. 3 hours/d vs. 6 hours/d CIMT therapy Outcome: QUEST Score Grasp/Release at 6 months

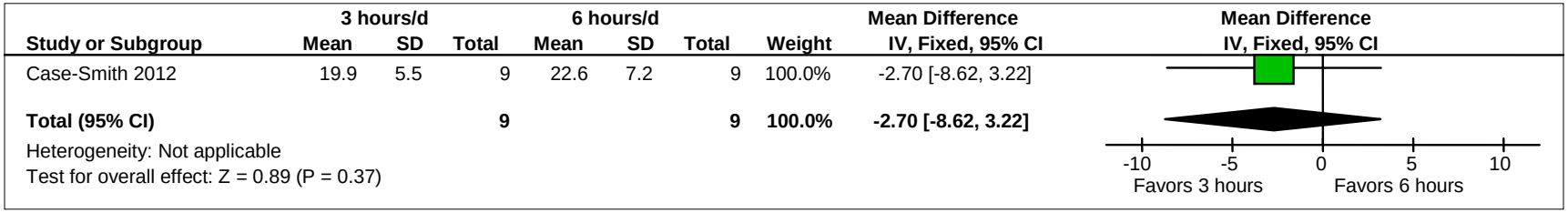


Figure 4.X. 3 hours/d vs. 6 hours/d CIMT therapy, Outcome: Dissociated Movement at 6 months

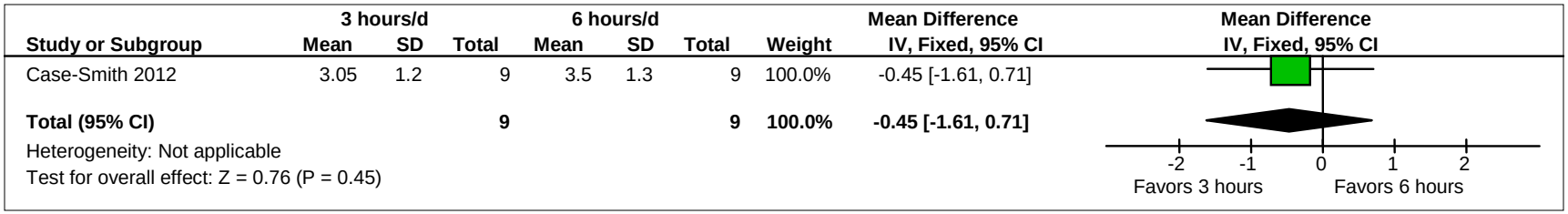


Figure 4.X. 3 hours/d vs. 6 hours/d CIMT therapy, , Outcome: PMAL frequency of use at 6 months

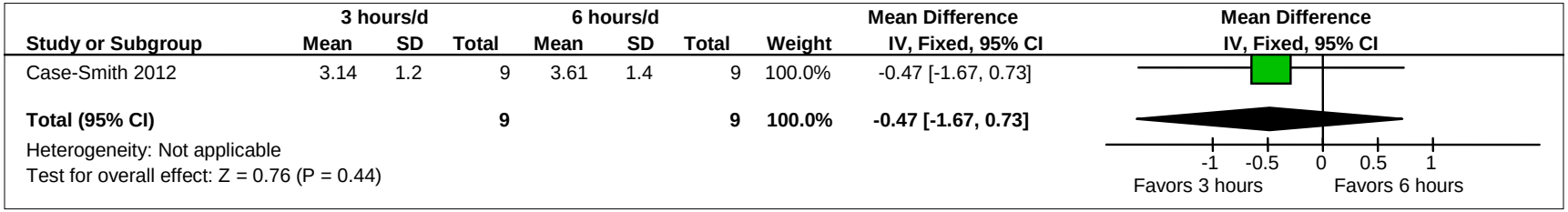


Figure 4.X. 3 hours/d vs. 6 hours/d CIMT therapy, , Outcome: PMAL Quality of movement at 6 months

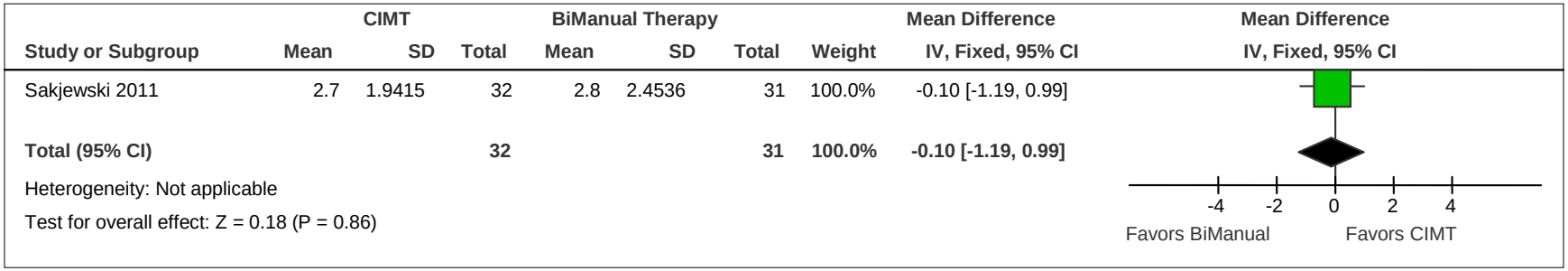


Figure 5.X. CIMT vs. BiManual: Outcome: Performance at 26 weeks

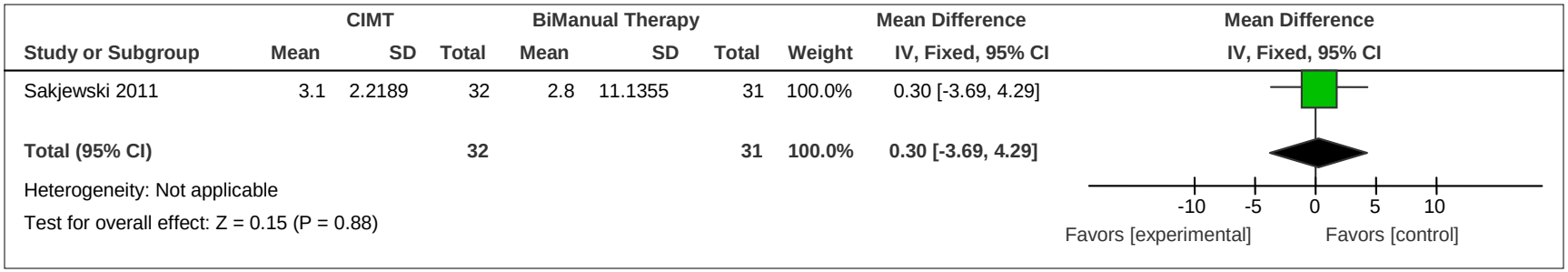


Figure 5.X. CIMT versus BiManual, Outcome: COPM Satisfaction at 3 weeks

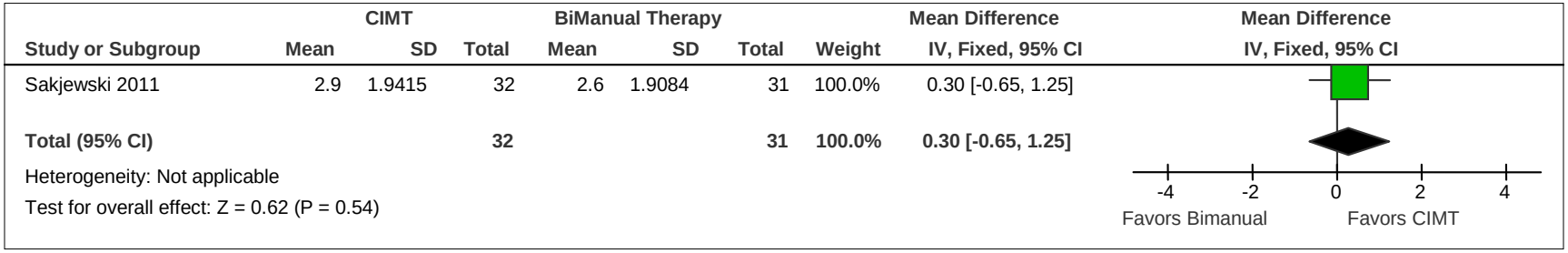


Figure 5.X. CIMT versus BiManual, Outcome: COPM Satisfaction at 26 weeks

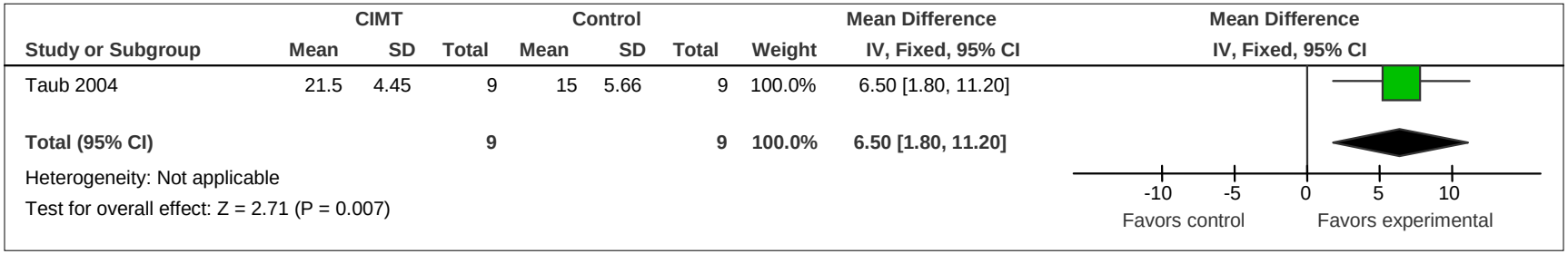


Figure 6.X. CIMT versus Standard, Outcome, Emerging Behaviors Scale, post treatment

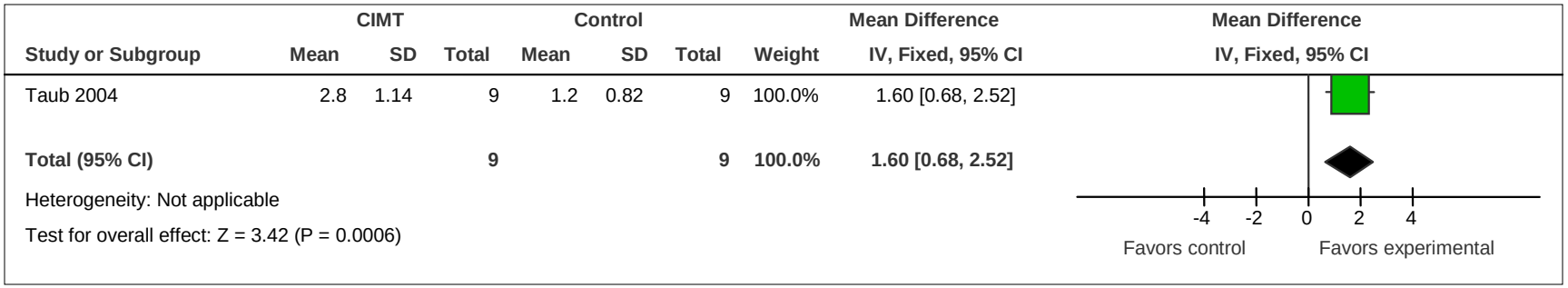


Figure 6.X. CIMT versus Standard, Outcome, PMAL, amount of arm use

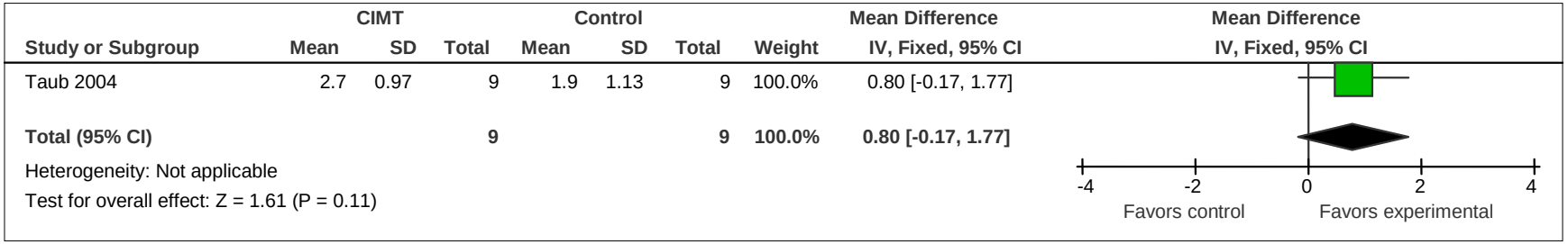


Figure 6.X. CIMT versus Standard, Outcome PMSL Quality of use post treatment

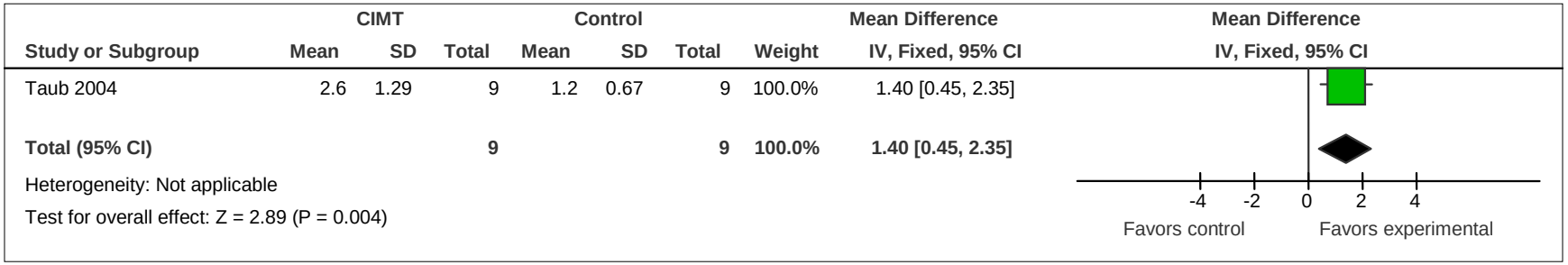


Figure 6.X. CIMT versus Standard, Outcome, PMAL, amount of arm use 3 week follow-up

Study or Subgroup	CIMT Mean	CIMT SD	CIMT Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Taub 2004	2.6	1.25	9	1.8	1.01	9	100.0%	0.80 [-0.25, 1.85]
Total (95% CI)			**9**			**9**	**100.0%**	**0.80 [-0.25, 1.85]**

Heterogeneity: Not applicable
Test for overall effect: Z = 1.49 (P = 0.14)

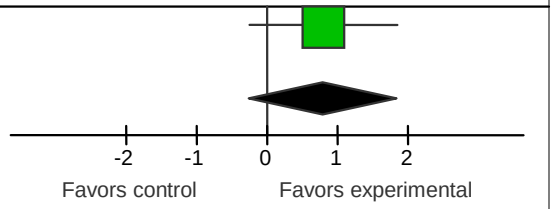


Figure 6.X. CIMT versus Standard, Outcome: PMAL, Quality of arm use 3-week follow up

Study or Subgroup	mCIMT Mean	mCIMT SD	mCIMT Total	Traditional therapy Mean	Traditional therapy SD	Traditional therapy Total	Weight	Mean Difference IV, Fixed, 95% CI
Yu 2012	10.5	3.6	10	10.5	2	10	100.0%	0.00 [-2.55, 2.55]
Total (95% CI)			**10**			**10**	**100.0%**	**0.00 [-2.55, 2.55]**

Heterogeneity: Not applicable
Test for overall effect: Z = 0.00 (P = 1.00)

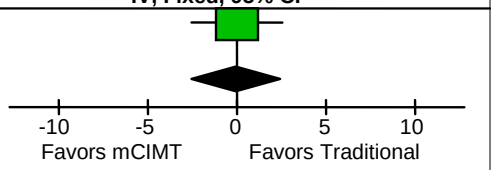


Figure 7.X. mCIMT vs Traditional therapy, Outcome: Grip Strength

Study or Subgroup	mCIMT Mean	mCIMT SD	mCIMT Total	Traditional therapy Mean	Traditional therapy SD	Traditional therapy Total	Weight	Mean Difference IV, Fixed, 95% CI
Yu 2012	51	10.3	10	46.6	8.5	10	100.0%	4.40 [-3.88, 12.68]
Total (95% CI)			**10**			**10**	**100.0%**	**4.40 [-3.88, 12.68]**

Heterogeneity: Not applicable
Test for overall effect: Z = 1.04 (P = 0.30)

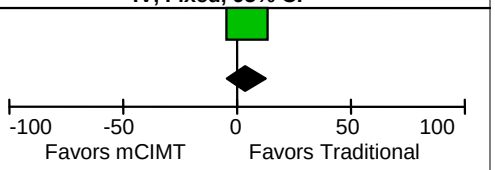


Figure 7.X. mCIMT vs. Traditional therapy, Outcome: Weefim Motor Score

Critically Appraised Topic (CAT)

Author, date, country, and industry of funding	Patient Group	Level of Evidence (Oxford)	Research design	Significant results	Limitations
(Bonnier, Eliasson, & Krumlinde-Sundholm, 2006)	Adolescents N= 9 Eight with mild hemiplegia One had moderate hemiplegia Day camp setting		Prospective before and after design Measures on six different functional tests were used. Measurements were taken pre, post and at 5 month follow up. 1. Bruininks-Oseretsky Test of Motor Proficiency (modified) Subtest 5 2. The Jebsen Hand Function Test 3. Grip strength-Grippit 4. Assessment of Motor and Process Skills (AMPS) 5. Manipulation	1.Bruininks-Oseretsky Test- the median point score increased from 13 points to 16 points after the intervention. At 5 months remained at 16 points 2. Jebsen Hand Function Test- time to complete the seven tasks decreased from 72.5 s to 49.3 s. After the intervention. At 5 months follow up the time to complete the task remained at 50 s 3.Grip Strength – did not change after the intervention or at follow-up 4. a. AMPS- Motor skills- did not change with intervention or at follow-up b. AMPS Process skills- did not change with intervention or at follow	Slings were not used to disable to dominant hand. It could be used to support. 8 of 9 subjects had mild impairments

			shift task 6. Frisbee golf One OT, not involved in the treatment phase took all measurements	up 5.Manipulation- shift task- the median score increased from 3 points to 6 points after the intervention. At the 5 month follow up the score remained higher at 4. This is a significant difference (P< 0.05) 6.Frisbee golf- the median tries to get the Frisbee in the basket was 20 throws, it decreased to 14 throws after seven practice sessions	
(Cimolin et al., 2012)	10 children with traumatic brain injury (TBI) versus 10 healthy children in the control group	4 Pre-post cohort study	CIMT glove for three consecutive hours for 10 weeks, 7 days per week. (4 days at home, 3 days at clinic)	**Besta** No difference on pre vs post test Besta for the outcomes 1.) Grip 2.) Bilateral manipulation **QUEST-** No difference on the pre vs. post Quest total score.	There is no mention of follow to assure parents completed the therapies at home 4 days of the week.
(Facchin et al., 2011)	Recruited 111 subjects N= 105 completed. Age – mean 4y 8 mo	4 poor quality cohort	Cluster randomized into three treatment group 1 CIMT (Glove plus intensive rehab- 3 hours per day, 3 days per	**mCIMT vs ST** **Besta Scale** mCIMT group showed significant improvement in the global score, grasp function significant worsening in ADLs	They report 43% of subjects were male, and 42% were female. What gender was the remaining 15% In the 2009 "Methods" paper (Facchin et al., 2009). They report 37 subjects reported

	(range 2-7 years) Hemiplegic CP who had never undergone restraint therapy		week) 2. Bimanual intensive rehab (IRP)- (3 hours per day, 3 days per week) 3. Standard (STD) (one to two hours per week, in one hour slots) Outcomes:: Quest Scale Besta Assessment	in 7-8 year olds **Quest Scale** mCIMT showed significant improvement on the global score, dissociated movements, and for protective extension Changes in other subscales were not significant. **<u>mCIMT versus IRP</u>** **Besta Scale** mCIMT was more effective than IRP in improving grasp function, but not significant. Changes in other subscales were not significant.	per group. In this paper they report on 39 recruited to the CIMT group, and 33 to each of the other groups
(Grinde & Myhre, 2012)	24 subjects Age range (17-86 months)	4 poor quality cohort	Retrospective study Treatment with CIMT- full program (6 hours per day, for 21 days) Outcomes Peabody Developmental Motor Scales-2 (PDMS-2) Assisting Hand Assessment (AHA)	PDMS_2 median motor skill score for all subtests were significantly improved from pre to post treatment AHA for 10 subjects measured, the median change in the sum score was improved, but not significantly	Abstract only Retrospective
(Wallen et al., 2011)		2b low quality RCT	Pragmatic randomized study	No difference that was clinically important or	Abstract only Therapy for Group 2 is not

		50 children randomized, uncertain how many were in each group Mean age 48.6 months	Two treatment groups, each included weekly OT and daily home program Group 1 modified constraint induced therapy (mCIMT) Group 2 Outcomes: Canadian Occupational Performance Measure (COPM)	statistically significant was detected at the end of therapy or at the 6 month follow-up.	described

Excluded studies	Reason for Exclusion
(Facchin, et al., 2009)	Methods only
(Park et al., 2012)	Only 3 subjects

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Excluded Studies

Facchin, P., Rosa-Rizzotto, M., Turconi, A. C., Pagliano, E., Fazzi, E., Stortini, M., & Fedrizzi, E. (2009). Multisite trial on efficacy of constraint-induced movement therapy in children with hemiplegia: study design and methodology. *Am J Phys Med Rehabil, 88*(3), 216-230. doi: 10.1097/PHM.0b013e3181951382 00002060-200903000-00006 [pii]

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