EVIDENCE BASED MANAGEMENT OF CEREBRAL PALSY
OBJECTIVES

What is evidence based practice?
What is the need for it?
What is Level of evidence?
How to read a evidence, interpret and apply in clinical practice?
What are the evidences in management of cerebral palsy?
Which are the evidences require more evidence & why?
Evidence Based Practice

* Evidence-Based Practice (EBP) is a thoughtful integration of the best available evidence, coupled with clinical expertise.

* An approach to decision making in which the clinician uses the best available evidence to decide which treatment option suits the patient.

* Addresses healthcare questions with an evaluative and quantitative approach.
Need of Evidence Based Practice

- Vast up-surge of literature available
- Unmet information needs
- Implementation delays
<table>
<thead>
<tr>
<th>LEVEL</th>
<th>DESCRIPTION</th>
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</table>
| LEVEL I | Randomized Control Trial (RCT)  
|         | Systematic Review (with homogeneity*) of RCTs |
| LEVEL II| Cohort study / low  
|         | quality RCT  
|         | Systematic Review (with homogeneity*) of cohort |
| LEVEL III| Case-Control Study (CCT)  
|         | Systematic Review (with homogeneity*) of case control Studies |
| LEVEL IV| Case-series (and poor quality cohort and case-control studies) |
| LEVEL V | Expert opinion |
INTRODUCTION

• For the child with CP the main aim of therapy should be to improve their quality of life with three general aims of:
  1) Increasing or improving the skill repertoire
  2) Maintaining functional level and general management
  3) Minimization of musculoskeletal impairments contractures and deformities.
INTRODUCTION

Common interventions usually address

- Reduction of the effects of abnormal muscle/postural tone,
- Musculoskeletal problems (muscle weakness and muscle length),
- Working for activity in a functional context
- Providing opportunities for practice.
INTRODUCTION

• Activity-based approaches aim to prevent secondary musculoskeletal impairments and maximise physical functioning, foster cognitive, social and emotional development of the child and develop, maintain and perhaps restore neural structures and pathways.
Topic to be covered

1. NDT; 31 articles
2. Strengthening; 20 articles
3. Treadmill training; 6 articles (all studies)
4. Balance training
5. Neuromuscular stimulation
6. Biofeedback
7. Casting
8. Stretching
9. Splinting
Topic to be covered

10. CIMT
11. Virtual reality
12. Frequency of physiotherapy; 4 articles (all studies)
13. Hydrotherapy
14. Hippotherapy
15. Conductive education
16. Medical management
17. Orthotic management
NEURO-DEVELOPMENTAL TREATMENT (NDT)
NDT

- NDT Common treatment approach
- Aims
  - Facilitate normal motor development and function
  - Prevent development of secondary impairments due to contractures and deformities focusing on sensorimotor components.
- The approach has changed over the years to incorporate carryover into activities of daily life and preparing for specific functional tasks.
NDT - Regimes

- Treatments individualised for each participant with:
  1) 1 hour, 2 x weekly for 6 weeks
  2) 75 mins, 3 x weekly for 6 weeks
  3) 50 mins 2 x weekly compared with 5 x weekly for 16 weeks
OUTCOME MEASURES

- **GMFM** (Gross Motor Function Measure)
- **PEDI** (Pediatric Evaluation Of Disability Inventory)
- **Pedographs**
- Gross motor age, Fine motor age, Motor age,
- **ROM** (Range Of Motion)
- **DDST** (Denver Developmental Screening Test)
- **COPM** (Canadian Occupational Performance Measure)
- **QUEST** (Quality of Upper Extremity Skills Scale)
NDT

- There was some evidence of NDT improving gross motor function in children with CP but once again further high level evidence is required.

- The literature for intensity of physiotherapy showed that there was no difference in outcome for different intensities of general physiotherapy treatment; however a more intense program of NDT did show more significant improvements in gross motor function.
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<thead>
<tr>
<th>+VE Result</th>
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<th>ND Result</th>
<th>NS Result</th>
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<tr>
<td>10&lt;br&gt;(3 RCT, 3ABA, 3 Cohort, 1 CS)</td>
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<td>Outcomes by Dimensions of Disability</td>
<td>Results Favoring NDT (Statistically Significant)</td>
<td>Results Favoring NDT (But Not Statistically Evaluated)</td>
<td>Results Favoring Control (SS)</td>
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<td>III (2)</td>
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<td>Outcomes by Dimensions of Disability</td>
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<td>Results Favoring Control (SS)</td>
<td>Results Not Different or Not Statistically Significant</td>
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<td>Functional Limitation/Activity</td>
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<td>Motor activities:</td>
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<td>I (1)</td>
<td>I(2), II(^{12, 16, 18, 18, 18, 18, 20}), III(27)</td>
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<td>II (1)</td>
<td>I(1), II (2)</td>
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<td>II(1)</td>
<td>I(1)</td>
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8 studied showed better improvement:

- Physiologic motor function (II)
- Qualitative movement (V),
- Movement time (IV),
- Percent of reach (IV); and
- Gait stride (IV) and step (IV) length, velocity (IV) and foot angle (IV).
MOTORIC RESPONSES

- Evidence are not consistent
- Five contrasting findings with stronger validity that spasticity, and/or reflex responses (I,II) were either not different or were more improved.
MOTOR DEVELOPMENT

- Fine motor age: 3 studies (I and II) no adv of NDT
- Gross motor age: were not consistent: one favored NDT (II13); the other showed no difference
- Overall Motor Age (i.e., average of gross and fine motor ages) were also not consistent:
  - one favored NDT (II)
  - but two more convincing results favored the control condition (I and I).
QUANTITY OF THERAPY

INTENSIVE INTERVENTION

- NDT 45 min. 2/wk. + home program 30 min./day + UE cast 4 h/day

Vs

Functional skills OT

- Intensive NDT 45 min. 2/wk. + 30 min/day home program

Vs

NDT 45 min. 1/mo. to 1/wk. + 15 min. 3/wk. home program
INTENSITY

- **INTENSITY**: No statistically significant beneficial effect of NDT was detected either when the
  - **Amount** of therapy each week was increased or
  - when the **number** of months of treatment was extended.
RECOMMENDATION

- No advantage of NDT over the alternatives to which it was compared.
- Only exception of immediate improvement in dynamic range of motion,
- No consistent evidence that NDT changed abnormal motoric responses, slowed or prevented contractures, or that it facilitated more normal motor development or functional motor activities.
RECOMMENDATION

- More intensive therapy did not seem to confer a greater benefit.
- There was also no clear evidence that NDT produced other potential benefits such as enhancement of social-emotional, language or cognitive domains of development, better home environments, improved parent-child interactions, or greater parent satisfaction.
REFERENCE

- AACPDM Evidence Report: Effects of Neurodevelopmental Treatment (NDT) for Cerebral Palsy
- Initial Publication in Database: July 2001
- Updated: March 2002
- Other Published Versions of this Evidence Report:
  Developmental Medicine and Child Neurology, 2001, 43:
  778-790
STRENGTH TRAINING
STRENGTHENING

• Progressive Resisted Strength Training programs:
  4-5 reps
  3 times weekly
  6-8 weeks
  starting at 65% maximum isometric strength.
  (Damiano, MacPhail; Engsberg; Eagleton; McBurney, Dodd & Morton)
STRENGTHENING

- Functional based programs used a number of exercise stations,
- 1 hour,
- 2 x weekly
- 4-6 weeks (Crompton & Blundell)
- repetitive practise (Ketelaar)
STRENGTHENING

- Post-operative strength studies used a set of exercises, 3 x weekly for 6 weeks (Seniorou M) and 9 months (Patikas & Patikas)
STRENGTHENING

- Others were 6 week programs of loaded sit-stand (Liao),
- general Strengthening (Lee)
- exercise bike (Williams)
OUTCOME MEASURES USED AND RESULTS

- GMFM used in 10 studies with:
  - significant improvements (Lia 2007; Damiano 1998),
  - non-significant improvement (Dodd 2003; Morton 2005; Williams 2007),
  - no difference between strengthening and control groups with both improving 17; 18; 31, and
  - no changes seen on GMFM 21; 22.
OUTCOME MEASURES USED AND RESULTS

- Dynamometry showed significant increases after strengthening quads (Damiano 1995, MacPhail 1995).
- Combined muscle strengths (Dodd 2003, , and other muscle groups). Non-significant increases and no differences between groups also seen.
OUTCOME MEASURES USED AND RESULTS

- Gait parameters:
  - no change in energy expenditure\textsuperscript{15, 16},
  - no significant change seen in velocity or cadence\textsuperscript{16, 14, 22, 24},
  - improvements in some gait parameters\textsuperscript{25, 18},
  - Significant increases in timed walk tests\textsuperscript{30, 25}. No increase in spasticity\textsuperscript{29, 20}
CLINICAL SIGNIFICANCE

- The evidence for strengthening shows that targeted strength training can improve the strength of particular muscle groups as measured at the body function and structure level without provoking increases in spasticity.
- There is evidence of more improvements in muscle strength than gait or functional parameters, thus carryover into activity and participation has not been shown using the dosages employed in the studies in this review.
TREADMILL TRAINING
TREADMILL TRAINING

- All used motorised treadmill with support harness
- Amount of support – began at 30% of body weight and reduced support to 0% over study period 33; 36.
- Some 20-30 mins, 2-3 x weekly for 6-12 weeks (37; 35; 32.)
- Others 2 x daily, 6 x weekly for 2 weeks (33; 36)
OUTCOME MEASURES USED AND RESULTS

- GMFM used in all studies except Dodd with variable results: Significant increases in 1 study only.
- Other studies show improvements in dimension D & E.
- Timed 10m walk used in 4 studies with improvements, but only 1 significant.
- Endurance (10 and 6 minute walk tests) showed either no change, non significant improvement.
- Other gait parameters showed no changes in velocity or cadence.
CLINICAL SIGNIFICANCE

• Clinically applicable
• however the results were mixed and there was a lack of evidence of significant changes for the better.
• Further evidence is required
BALANCE TRAINING
Harris and Roxborough published a systematic review of 12 studies examining the efficacy and effectiveness of physical therapy postural control interventions for children with CP.

The authors reported on limited evidence, Sacket levels three to five, for all studies reviewed.
BALANCE TRAINING

- Ledebt and colleagues 41 demonstrated improved gait symmetry and balance in children with hemiplegic involvement following a six week intervention program of three sessions per week.
Woollacott et al. and Shumway-Cook et al. examined massed practice effects of balance training on muscle activity and stability in six children with hemiplegic and diplegic CP.

A moveable foreplate system (NeuroCom) was used to deliver 100 perturbations per day over a five days of intensive training schedule.

Improvements in the standing subsection of the GMFM and select measures of balance from the force platform were reported, providing additional support for balance training for children with CP.
NEUROMUSCULAR ELECTRICAL STIMULATION
Kerr et al published a systematic review to examine the efficacy of electrical stimulation for strengthening or to improve motor function of children with CP.

Eighteen articles were reviewed with six of the articles classified as RCTs. Twelve (12) of the articles examined the use of neuromuscular electrical stimulation (NMES) and six (6) Threshold e-stim (TES).

Difference NMES is applied to obtain a palpable contraction where TES is applied subthreshold to a muscle contraction.
Neuromuscular Electrical Stimulation

- Kerr reported evidence from three RCTs that NMES has been shown to improve motor control through an increase in GMFM scores.
- But conflicting and inconclusive evidence from three RCTs is seen for TES for either improvement of muscle strength or motor function in children with CP.
NEUROMUSCULAR ELECTRICAL STIMULATION

• Kerr and colleagues examined the efficacy of NMES and TES in strengthening of the quadriceps and did not find any significant findings.

• Ho and colleagues examines NMES applied to the gastrocsoleus complex to reduce muscle stiffness and to study the effect on select gait temporal-distance measures. The authors reported significant results in improving selected walking measures, but not muscle stiffness.
# NEUROMUSCULAR ELECTRICAL STIMULATION

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<tr>
<th>Author, year</th>
<th>Topic</th>
<th>Level of Evidence</th>
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<tbody>
<tr>
<td>Dali et al, 2002</td>
<td>TES and PT</td>
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<tr>
<td>Hazelwood et al, 1994</td>
<td>NMES and PT</td>
<td>1</td>
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<tr>
<td>Park et al, 2001</td>
<td>NMES and PT</td>
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<tr>
<td>Sommerfelt et al, 2001</td>
<td>TES, stretching and PT</td>
<td>1</td>
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<tr>
<td>Steinbok et al, 1997</td>
<td>TES and PT</td>
<td>1</td>
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<tr>
<td>Van der Linden et al, 2003</td>
<td>NMES and PT</td>
<td>1</td>
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</table>
BIOFEEDBACK

- No systematic reviews or RCTs were identified addressing the issue of biofeedback and gait training in children with CP.
- The use of auditory and visual surface EMG biofeedback has limited evidence.
- Only the Dursun article included randomization of treatment assignment in their study design and that was to contrast the use of biofeedback to the use of conventional exercise.
Biofeedback was used by the authors to treat dynamic equinus with a cohort of 21 children receiving both exercise and biofeedback in comparison to an exercise only group.

Both groups significantly improved gait function, but it was the biofeedback group that significantly improved muscle tone and active ankle range of motion.

The authors concluded that biofeedback was an effective intervention for dynamic equinus in children with CP.
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<th>Author, year</th>
<th>Topic</th>
<th>Level of Evidence</th>
<th>Level of</th>
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<tbody>
<tr>
<td>Bolek, 2003 52</td>
<td>Surface EMG (SEMG) for Dorsiflexion</td>
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<tr>
<td>Colborne et al, 1994 53</td>
<td>PT or SEMG for Plantarflexors</td>
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<tr>
<td>Dursun et al, 2004 51</td>
<td>SEMG for equinus</td>
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<td>Flodmark, 1986 54</td>
<td>SEMG for gait training</td>
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<tr>
<td>Kassover et al, 1986 55</td>
<td>Auditory EMG for heelstrike</td>
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<tr>
<td>Seeger et al, 1981 56 &amp; 1983</td>
<td>Auditory EMG for gait symmetry</td>
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<td>4</td>
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<tr>
<td>Toner et al, 1998 58</td>
<td>SEMG, strengthening &amp; ROM for ankle function</td>
<td></td>
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CASTING
CASTING

- AACPDM (2007) published an evidence report which included a systematic review of casting, either alone or in combination with botulinum toxin type A on equinus in children with CP.
- Of the 22 articles reviewed, 12 reported on casting as a sole intervention with only one being a level two RCT and the others providing level four evidence.
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<tr>
<th>Author, year</th>
<th>Topic</th>
<th>Level of Evidence1</th>
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<tbody>
<tr>
<td>Bertoti 1986 60</td>
<td>Inhibitive casts &amp; PT</td>
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<tr>
<td>Cameron and Drummond, 1998 63</td>
<td>Serial casting and PT</td>
<td>4</td>
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<tr>
<td>Cottalorda et al, 2000 64</td>
<td>Serial casting</td>
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<td>Dvir et al, 1991 65</td>
<td>Serial casts &amp; NDT</td>
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<tr>
<td>Hinderer et al, 1988 66</td>
<td>Bivalved casts &amp; NDT</td>
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<tr>
<td>Otis et al, 1985 67</td>
<td>Bivalved casts</td>
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<td>Sussman and Cusick, 1979 68</td>
<td>Inhibitive casting &amp; PT</td>
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<td>Tardieu et al, 1982 69</td>
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<tr>
<td>Watt et al, 1986 70</td>
<td>Inhibitive casts &amp; PT</td>
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CASTING

- The small level two RCT by Bertoti examined 10 weeks of intervention in 16 children with CP where were randomly assigned to a NDT only or NDT plus casting group.
- A significant percent increase in stride length was found, but other gait variables were non-significant.
- In reviewing all casting literature, concluded that there was little evidence to support casting versus no casting, but that a no-intervention control group has not been used in any RCT on the intervention.
CASTING

- Many of the studies demonstrate a return to baseline values at follow up and it is unclear whether the improvement seen in range of motion is improved stretch tolerance or actual increased range due to the outcome measurement methodology that is typically used.
STRETCHING
STRETCHING

• Two systematic reviews examining the effect of passive stretching to improve range of motion or to affect spasticity in children with CP.

• Pin and colleagues identified 10 studies, of which, four were RCTs on the topic. Overall the authors reported limited evidence for passive stretching to improve range of motion.

• The authors reported some evidence for increased range of movement following stretching and decreased spasticity, but no lasting effect.
STRETCHING

- Sustained stretching was preferred to manual stretching.
- Wiart reported on seven studies with three RCTs and the paper overlapped the findings of Pin and colleagues.
- The findings of Wiart also reported limited evidence for passive stretching, active stretching or for positioning to improve range of motion in children with CP.
STRETCHING

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<tr>
<th>Author, year</th>
<th>Topic</th>
<th>Level of Evidence</th>
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<td>Miedaner &amp; Renander, 1987 73</td>
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<tr>
<td>O’Dwyer et al, 1994 24</td>
<td>Passive stretching</td>
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<tr>
<td>Richards et al, 1991 74</td>
<td>Single prolonged stretch</td>
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<tr>
<td>Tremblay et al, 1990 75</td>
<td>Single prolonged stretch</td>
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SPLINTING

- Does daily use of a hand splint in children with cerebral palsy result in enhanced hand movement patterns and more functional use of the hand?
SPLINTING

- Nine studies.
- Children were of varying ages (infants to adolescents) with quadriplegia or hemiplegia.
- Sample size for 8/9 studies was small (1-12 subjects).
- Interventions typically involved pre- and post-testing after a period of weeks to months of daily use of a hand splint, with no RCTs.
SPLINTING

- Variety of hand splints used
- Primary goal aligned neutral position and/or to inhibit spasticity.
- Outcome measures - predominantly observational, with one study using a three-dimensional tracking system.
SPLINTING

- Results: improvements in hand and arm use, including grasp, better range of motion and hand positioning, and decreased spasticity.
- Muscle strength did not improve.
- Only one study found no positive effects.
- Improvements in functional activities were not supported by these studies.
SPLINTING

- In Review article by Teplicky et al reported that hand splints appear to improve grasp but the ability to use the hand more functionally in everyday tasks remains unclear.
- Existing studies suggest that splints may be more helpful in children with more severe limitations, however this requires empirical support.
- Furthermore, the choice of the type of splint needs to be task-specific.
CASTING

- Goal of castings
  - Inhibiting spasticity and maximizing range of motion.
- Casts were worn several hours per day, for weeks to months.
- Casting was viewed as an adjunct to other rehabilitation treatment approaches.
- Outcome measures included observational data, measurement of range of motion,
- Quality of upper extremity movement and motor skills.
CASTING

- Results suggest improvements in passive and active range of motion, and decreased spasticity.
- Improvements in upper extremity movement quality, is unclear.
- Improvements are not sustained on follow-up assessment.
CONCLUSIONS AND FUTURE DIRECTIONS:

- It transiently improve range of motion, with some possible effects on decreasing spasticity and improving quality of movements.
- The lack of high level evidence limits the ability to strongly support or disprove the short and long-term effectiveness of upper limb casting.
- Clinical indicators for casting appear to be presence of soft tissue contracture, spasticity and limited joint range.
CASTING

- In future studies, outcome measures need to focus on hand function.
- Casting in conjunction with tasks Specific training
HAND USE: CONSTRAINT-INDUCED MOVEMENT THERAPIES
HAND USE: CONSTRAINT-INDUCED MOVEMENT THERAPIES

- CIMT therapy is restraint of the uninvolved hand and intensive practice with the involved hand, i.e. hemiplegic hand, during a specified time period.
- The principle of CI therapy was developed through neurophysiological research by Dr Edward Taub during the 1950s.
• More than 30 articles are done in 90’S
• Strict criteria for its selection and effectiveness
• 10 of wrist and finger extension is required
• This reverses the learned nonuse phenomenon.
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<td>1</td>
<td>Charles et al 2006</td>
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<td>Taub et al 2004</td>
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<td>Willis et al 2002</td>
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<td>Elaisson et al 2005</td>
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<td>ordon et al 2006</td>
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<td>6</td>
<td>Charles 2006</td>
<td>Yes</td>
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<td>Edward Taub 2007</td>
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<td>Deluca 2006</td>
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<td>Deluca et al 2003</td>
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<td>Naylor et al 2005</td>
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Method of constraints

- Holding a child’s hand (Naylor 2005),

- Using a glove or mitt (Eliasson 2003; Eliasson 2005; Pierce 2002),

- Forearm splints (Crocker 1997; Glover 2002),
Method of constraints

- **Slings** (Charles 2001; Gordon 2005),

- **Short arm casts** (Willis 2002; Sung 2005),

- **Long arm casts** (deluca 2002; deluca 2003).
Conclusion and future directions

Large well controlled studies are lacking. Multi-centre studies are recommended since the prevalence of hemiplegic CP is fairly low.

The evidence is still tentative but there are no studies reporting negative results. The training methods need further investigation, especially in relation to other types of intensive training programmes and with a longer follow up periods.
Conclusion and future directions

- No studies have so far been using orthoses in combination with CI therapy and this might be an interesting avenue for further research.
PLAY: VIRTUAL REALITY
Virtual reality (VR) is a virtual environment system that uses a range of computer technologies that present virtual or artificially generated sensory information in a format that enables the user to perceive experiences that are similar to real-life events and activities.
PLAY: VIRTUAL REALITY

- A three-dimensional simulated environment of objects and activities is created and presented either on a computer monitor, or projected on a large screen or within a helmet-mounted display.
- Specific input devices (e.g. dataglove) allow the user to interact actively with the virtual environment.
PLAY: VIRTUAL REALITY

- VR provides the user with the opportunity not only to sense the virtual environment, but also to interact and explore the environment, relatively free of limitations imposed by their disability.
PLAY: VIRTUAL REALITY

- The literature in this area is now emerging (since 2002) and remains fairly preliminary, however evidence to date suggests that VR may prove to be a useful therapeutic modality for children with cerebral palsy.

- A wide range of potential uses of VR are being proposed and tested, therefore validation of findings is needed.
FREQUENCY

- Two assessed 4 groups combining aims or goal directed therapy with routine or intense frequency for 2 weeks (Bower E, 2001) and 6 months (Bower E, 1196).
- Christiansen AS (2008) compared intermittent bursts with continuous PT.
- Steinbok P (2002) examined effects of pre-SDR intense PT program. Steinbok P
Outcome measures used and results

- GMFM primary outcome measure in all studies.
- There were no significant differences in GMFM between different intensities in any study.
TRUNK TRAINING

• Butler PB. (1998) examined effect of individualised targeted trunk training using specialised equipment for 1-2 trunk joints at a time.

• All children gained independent sitting within 12-25 weeks but other results not analysed clearly.
TRUNK TRAINING

- Shumway-Cook A (2003) assessed effects of 5 consecutive days of balance training using movable force plate system (45).

- Significant improvements seen in centre of pressure and reduced time to recovery of balance perturbation (45).
RECOMMENDATIONS

- More of the evidences are in the field of body function and structure (impairment)
- Followed by few on Activity
- Very few evidences explored the domain of participation and performance in environment its effect.
RECOMMENDATIONS

• Moderate evidence (Grade B) is present on effectiveness of upper extremity treatment, constraint-induced therapy, use of a functional approach to improving gross motor skills and use of NMES to improve gait function.
RECOMMENDATIONS

- Limited evidence (Grade C) for NDT as a treatment approach, the use of balance training to improve sitting or standing balance, the use of biofeedback to improve gait and the use of casting to improve equinus.

- Inconsistent evidence (Grade D) or moderate evidence for the ineffectiveness of strength training for walking velocity or stride length and for passive stretching to increase range of motion and for the use of TES to improve gait.
SPINAL ORTHOSES

- Do spinal orthoses improve posture, balance and associated control of the head neck and upper extremities in children with cerebral palsy when compared to unbraced conditions?
- Do spinal orthoses have a negative impact on pulmonary or circulatory function in children with cerebral palsy compared to unbraced conditions?
- Do spinal orthoses prevent or delay curve progression compared to natural history in children with cerebral palsy?
Conclusions and Recommendations: Spine

- TLSO’s improved balance and stability with positive secondary effects in the form of improved control of the extremities, head, neck and trunk.
- Respiratory compromise associated with the use of TLSO’s appear to be unfounded.
- TLSO’s slows or halts curve progression
Conclusions and Recommendations: Spine

- Curve flexibility may be a good predictor of the efficacy of TLSO’s in slowing the progression of spinal curvatures.

- Adjunctive treatment –
  - Intrathecal baclofen pumps
  - Dorsal rhizotomies
    influence the natural history of spinal deformities

- The extent to which this will affect bracing recommendations and outcomes remains to be seen.
HIP ORTHOSES

- Do hip orthoses prevent progressive hip subluxation compared to natural history in children with cerebral palsy?
- Do daytime hip orthoses improve gross and/or fine motor function in children with cerebral palsy compared to unbraced controls?
- Do daytime orthoses increase muscle activity in hip adductors in children with cerebral palsy compared to unbraced muscle activity?
Conclusions and Recommendations: Hip

- very little evidence to support or oppose the use
- Static hip orthoses and their impact on hip subluxation rates have not received objective scrutiny.
- Functional hip orthoses such as the SWASH do not appear to impact hip displacement rates, but may be better tolerated than their static predecessors.
- SWASH: Standing Walking and Sitting Hip
Conclusions and Recommendations: HIP

- The basic purposes of functional hip abduction orthoses in
  - Discouraging scissoring gait patterns and
  - Improving sitting stability have received limited scrutiny.

- Hip abduction appears to be an important component of functional sitting postures.

- The use of hip orthoses in facilitating this alignment has been observed.
UPPER EXTREMITY ORTHOSES

- Do the combined modalities of dynamic assist upper extremity orthoses and functional stimulation of antagonist muscle groups decrease upper limb spasticity and/or improve upper limb function in children with cerebral palsy?
- Do dynamic assist upper extremity orthoses maintain upper extremity range of motion more effectively than static splinting modalities in the treatment of patients with cerebral palsy?
- Are there established benefits associated with the bracing of the wrist joint with static and/or dynamic splints in children with cerebral palsy?
UPPER EXTREMITY ORTHOSES

- combination of dynamic assist bracing and electrical stimulation is effective in reducing upper extremity tone and improving dexterity and grip.
- However, the treatment effect has not been shown to endure once the modalities have been discontinued.
- The use of dynamic extension assist joints at the elbow as an adjunct to serial casting has been reported.
- Compliance with these bulky devices appears to impact their effectiveness.
ORTHOSIS COMBINED WITH LYCRA GARMENTS

- Are there established benefits with respect to upper extremity function associated with the use of lycra garments in children with cerebral palsy?
- Are there established benefits associated with the use of lycra garments with respect to lower limb function in children with Cerebral Palsy?
- Are there established benefits associated with the use of Johnstone pressure splints in the management of children with cerebral palsy?
LYCRA

- Some benefit in individual cases.
- Hypotonic patients and patients with athetosis may derive the greatest benefit.
- However, these benefits were often found to be comparatively small and were often offset by other detrimental effects of the devices.
JOHNSTONE PRESSURE SPLINTS

- Adjunct to NDT physical therapy with respect to improvements in ROM, reduced spasticity and improved sensory function.
- Benefits associated with JPS do not appear to be as significant as those gained through the use of BTX injections.
LOWER LIMB ORTHOSES
DO LOWER LIMB ORTHOSES INFLUENCE THE TEMPORAL AND SPATIAL PARAMETERS OF GAIT?

VELOCITY

- velocity in hemiplegic gait - significant increases
- diplegic subjects is equivocal, (little/no effect)
- shoes alone also can increase velocity.
- future research: isolates the effect of orthoses from that of footwear.
LOWER LIMB ORTHOSES

- CADENCE
- in hemiplegia - significant reduced using a variety of AFOs.
- in diplegia are more equivocal
### LOWER LIMB ORTHOSES

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OTHER THERAPY
HYDROTHERAPY

- Review: From one lower-quality review on aquatic interventions (Getz et al. 2006) we included 1 RCT (Dorval et al. 1996) and 4 observational studies on children with CP (N=68).
- The conclusion was that hydrotherapy might improve respiratory function in children with cerebral palsy.
HIPPOTHERAPY

- Reviews: One high-quality (Snider et al. 2007) and one lower-quality (Sterba 2007) review compared therapist-directed hippotherapy to recreational horseback riding therapy (HBRT).

- These reviews included 3 RCTs (MacKinnon et al. 1995; Benda et al. 2003; Cherng et al. 2004) and 7 observational studies (N=100). Of these 2 RCTs (MacKinnon et al. 1995; Cherng et al. 2004) and 6 observational studies were included in both reviews.
HIPPOTHERAPY

- Snider et al.’s (Snider et al. 2007) results indicate that hippotherapy has short-term positive effects on muscle symmetry in the trunk and hip and that therapeutic horseback riding is no more effective than other therapies for improving muscle tone.
- Evidence from observational studies showed positive effects of both hippotherapy and therapeutic horseback riding on activities.
HIPPOTHERAPY

- The lower-quality review (Sterba 2007) stated that clinicians and therapists can recommend hippotherapy as an efficacious, medically-indicated therapy for gross motor rehabilitation of children with CP.
THANK YOU