RESEARCH POWER HOUR +

Clinical Professor Gay Girolami  PT, PhD, C/NDT, Coordinator Instructor
Therese McDermott  CScD, CCC-SLP, C/NDT, Speech Language Instructor
Debbie Evans-Rogers  PT, PhD, PCS, C/NDT, Coordinator Instructor
Kate Bain  OT, HScD, C/NDT, OT Instructor

NDTA Contemporary Practice Model™
- and evidence based practice

NDTA VISION
To advance utilization of the NDTA Contemporary Practice Model™ through clinical intervention, education, and research so that clients with neuromuscular dysfunction can participate in life to their fullest potential.

NDTA Contemporary Practice Model™ Research & Evidence Based Practice
Robust research methodologies applied to comprehensive intervention approaches are urgently needed for -

- Any level and severity of CP in GMFCS, MACS and FCCS classification - including with bilateral, severe & multiple disabilities
- Who require intervention towards any requested daily task improvement . . so that they can ‘participate in life to their fullest potential’

Adults with stroke . .
Our most important research question?

. . Does our intervention impact the particular
functional goals that our clients are requesting?

And how do we measure that?

NDTA Contemporary Practice Model™ Research

Daily task requests
& whether our intervention has an effect -
Did intervention help my client in . . .

Communicating more easily with friends
through better production of sounds in phonation?

Taking part in a group ‘construction game’ at preschool
through improved hand skills?

Improving a golf swing through more effective balance?

Published, peer reviewed research -
EBP* for families seeking therapy?

Holland, H., Blazek, K., Prim Haynes, M., & Dallman A.
(2019) CATCH* . . . Combined Approach to Treatment
for Children with Hemiplegia’

*Evidence Based Practice
Doctoral studies

The Sydney eScholarship Repository / Postgraduate Theses / Sydney Digital Theses / The University of Sydney, June, 2011.

Pilot study 3: A descriptive study of outcomes & follow up of 12 children with moderate to severe CP who received intensive NDTA Contemporary Practice Model™ intervention during a C/NDT course in Australia (Suzanne Davis Bombria CI).

Pilot study 3:
Outcome Measures

Videoanalysis / GAS

‘Measures of Processes of Care’ (King, et al ’95)

Logger Pro with Excel (finalcutpro)

Taxonomy -
Results

Blinded CI rating generated evidence to support the use of intensive short term NDTA Contemporary Practice Model™ intervention
- p value .001 baseline / pre test - to post test
- performance maintained to 6 weeks follow ups

Qualitative studies: -

RCT

“Moving & Doing – Functional Outcomes of NDT –
A Multi-Modal, Goal Focused Intervention to Promote the Performance of Daily Living Tasks by Children with Neuromuscular Disorders:
A Randomised Controlled Trial”
(Bain, K., Donelly M., Davis Bombria S., Chapparo C., Heard R., Treacy S., & Reddihough D.)

METHODOLOGY
A child friendly, clinic based protocol . .
2 phase study investigated the impact of intervention on the performance of requested daily tasks - Examples . .

Matched pairs randomly allocated to NDTA Contemporary Practice Model™ intervention or Alternative Treatment in a controlled trial
No other interventions received in the trial & filming periods
Overall 27 children 12m -15 y GMFCS, MACS & FCCS 1-V
250 quad video + zoom recorded performances of family identified goals, & the best of 3 trials recorded at pre, post & follow up filming were randomised, & rated with GAS® by expert U.S. CI blinded raters
Qualitative studies, VICON® motion analysis & treatment Fidelity Measures from the overall 500 hrs of intervention were also undertaken
1. GAS & Video Motion Capture

<table>
<thead>
<tr>
<th>GAS goals</th>
<th>Vicon® Measures</th>
<th>Pre intervention</th>
<th>Post intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Transition . .</td>
<td>Amount of combined R. knee &amp; hip flexion .</td>
<td>115.9°</td>
<td>237.2°</td>
</tr>
<tr>
<td></td>
<td>time taken</td>
<td>75 seconds</td>
<td>53 seconds</td>
</tr>
<tr>
<td></td>
<td>Hands on assistance</td>
<td>23 seconds</td>
<td>4 seconds</td>
</tr>
<tr>
<td>2. Communication . .</td>
<td>Forward displacement of index finger to point to .</td>
<td>115.3mm</td>
<td>146.6mm</td>
</tr>
<tr>
<td></td>
<td>Speed</td>
<td>44% faster than at Pre</td>
<td>Average ant pelvic tilt: -25.58°</td>
</tr>
<tr>
<td></td>
<td>with movement forward / pelvic anterior tilt .</td>
<td></td>
<td>Average ant pelvic tilt: -3.5°</td>
</tr>
</tbody>
</table>

Table 2: Vicon Motion Capture® abbreviated samples

2. Vicon Motion Capture®

Was able to quantitatively validate components of GAS goals

3. Qualitative studies

Parents felt well supported by their therapists & valued their new skills & their children's skill building and achievements (Burritt, '17)

"If you don't look after the parent, nothing happens: The experience of parents as their children participated in a program of contemporary Neuro-Developmental Treatment"

(Burritt L., & Donelly M. Submitted to the Journal: Child Care, Health and Development)

Parent feedback at follow up contributed to understanding possible causative links between:

Intervention . . . and the children's participation level goal achievements

Table 1. External ratings analysed by research team's statistician at Sydney University - Mann–Whitney U & Wilcoxon signed-rank tests

Inter rater reliability: Kendall's W nonparametric intra-class correlation coefficient $W = 0.93$ (‘very strong correlation’)
4. Fidelity study

Analysis continues towards writing:
'A Fidelity Study of
NDTA Contemporary Practice Model™ intervention -
A compendium of NDT treatment strategies from
a Randomised Controlled Trial'

Bain K. & Davis Bombria S.

CONCLUSION

In this small study comprising multi modal intervention,
preliminary results indicate that NDTA Contemporary Practice
Model™ intervention was superior to Alternate treatment in
assisting children with a wide range of neuromuscular
performance, age levels & daily task goals to make positive
changes in participation level functional skills.

Limitations: The relatively small numbers of children

Recommendations made for future research

NDT RESEARCH COMMITTEE

Assistance for clinician researchers & academician teams -
with encouragement, support, funding, articles,
research methodology ideas
. . . & much much more
Towards efficacy - NDTA Contemporary Practice Model™ peer reviewed research.
Committee comprises: C/NDT instructors / clinicians / academicians; PT/OT/SLP; ped & adults

**Initiatives & Task Forces**

- Mini-Grant program
- NDTA Research Foundation
- Fidelity Measure Task Force
- Posters program - National Conference
- ‘Examining The Evidence’ Articles
- Outcome Measures Working Group
- NDTA website Research Page
- NDTA research video / webinar - C/NDT courses?

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Our primary role as the Research Committee is to encourage & emPOWER you to take steps towards research in our field if this is something you are interested in doing . . .

We’re here to support you!

Kate Bain
Chair NDTA Research Committee
kathrynmbain@gmail.com

Thank you

NDTA Contemporary Practice Model™:

Systematic reviews call for more research to support therapy practice & resource allocation - & this applies to our practice model

RESEARCH POWER HOUR + Q&A

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Bibliography


Burritt L & Donnelly M. ‘If you don’t look after the parent, nothing happens: The experience of parents as their children participated in a program of contemporary Neuro-Developmental Treatment’ Submitted to Child: Care, Health and Development.


Copyright Kathryn Bain 2020
Mobbs C., (2017). Poster Presentation “How can we measure participation in infants and young children?” — ‘Dare Greatly enter the Arena’, 71st annual Meeting, AACPDM, Sept 2017, Montreal, Canada


Vicon Motion Analysis. https://www.vicon.com

Email: charlene@Imperial.ac.uk 2015 IEEE Sensors Journal, 15 (5)

Starting with an idea

- My professional experience in use of the NDTA Contemporary Practice Model supports improved functional outcomes related to speech intelligibility in children with cerebral palsy and other neuromuscular disorders.
- How do establish evidence?

Statement of the Problem

- Early stages of evidence regarding dysarthria treatment in CP
- Need to identify the relationship between specific respiratory tasks and improvement in speech function.
- Can improvement be achieved solely through respiratory activities, or is there a need to treat all aspects of the respiratory system?
- Speech breathing requires integration of both single system and multi-system processes.
Research Question/Claim

**Question** - In children with CP, will the combined use of NDT and a systems-based treatment approach improve speech intelligibility in single words and connected speech?

• Will this combined approach be even more effective in facilitating improvement in speech intelligibility?

**Claim** - Combining the NDT treatment components and system-based treatment will result in improved speech breathing across speech units, with extension to improvement in speech intelligibility.

Hypothesis

• Use of the SSA approach and Combined SSA/NDT approaches will result in improved performance in selected respiratory/phonatory tasks, and generalized gains in speech intelligibility at the single word and conversational speech levels.

• The combination of SSA/NDT will result in greater rate and magnitude of changes in these areas.
Standard of Practice in Dysarthria Treatment

Assessment
- Identify all possible speech subsystems impacting phonation and/or speech production.

Treatment
- Most effective strategy for improving speech intelligibility in children with dysarthria/CP is a multi-system approach.
- Prioritize the respiratory system in treatment.

Therese McDermott-Winter, CScD, CCC-SLP, C/NDT

Speech Subsystems Model:
- Respiratory
- Laryngeal
- Resonatory
- Articulatory

Evidence for current dysarthria treatment approaches:
- Single System Approaches
  - Traditional articulation therapy
  - PROMPT
- Multi-System Approaches
  - Speech systems approach
  - Lee Silverman Voice Therapy (LSVT)
What's the current evidence ....
◦ Use of NDT in the treatment of developmental dysarthria in children with cerebral palsy
◦ Strongly recommended in the academic literature
◦ No empirical evidence for NDT in this area
◦ What next?
◦ Explore efficacy studies in treatment approaches to developmental dysarthria in children with cerebral palsy
◦ How do they correlate with theory and constructs of NDT ... Find a common thread.

Treat the respiratory system first!

Related Information/ Evidence

- Postural Control
- Respiration
- Requirements for Speech Breathing
- Shape and influence of the chest wall on Respiration/Speech Breathing
- Relationship between Postural Control and Respiration

Efficacy for NDT

- Trunk stability, postural activity and motor performance
  - Girolami and Campbell, 1994
  - Arndt and colleagues, 2008
- Intensity of treatment/ Effective Treatment Dosing
  - Tsorlakis and colleagues, 2004
- Interdisciplinary Approach to Treatment
  - Improvement in functional speech production
    - Evans-Rogers and colleagues, 2015
Conclusions

- Multisystem dysarthria treatment approaches
  - Prioritize the respiratory system (Love, 2000; Strand, 1995)
    - Lee Silverman Voice Therapy (LSVT®) – Boliek & Fox
    - Speech Systems Approach (SSA) – Pennington & Colleagues
  - NDT – practice model that incorporates direct treatment to address system impairments contributing to inefficient speech breathing and speech production
  - NDT + Multisystem speech treatment as efficacious approach?

RESEARCH DESIGN

- Single Subject/Case Research Design
  - Quantitative experimental research approach
  - Baseline Logic - subjects serve as their own controls
    - Baseline or control condition
    - Intervention
  - Target behavior is repeatedly measured in varied designs
  - Analyze independently the effect intervention has on each participant
    - Visual analysis guidelines
      - Levels, trends, and stability
    - Descriptive statistics
      - Mean, median, mode, range
Investigation Design – SCRD - A-B-A2-BC

1. A = Baseline • fixed schedule (4 sessions)
2. B = SSA • (6-8 sessions) • 60 minutes protocol sequence
3. A2 = wash out phase
4. BC = SSA + NDT • (6-8 sessions) • 60-minute duration
   • First 20 minutes of session NDT
   • Preparation strategies (protocol)
   • Next 40 minutes NDT integrated with SSA protocol

Methods: Independent Variable
Speech Systems Approach to Dysarthria Treatment (SSA)

SLP provides multi-sensory cues to facilitate greater respiratory control and coordination across a variety of speech acts

Primary Tasks:
• Sustained vowel duration
• Quick inhalation, followed by controlled exhalation
• Use of slowed rate of speech
• Appropriate pausing for breath

Sample – Speech Systems Treatment Protocol

<table>
<thead>
<tr>
<th>Task</th>
<th>Strategy</th>
<th>Response Activity</th>
<th>Materials</th>
<th>Goal</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory and phonatory coordination with sustained vowel sound</td>
<td>• Sustained vowel production followed by quick inhalation and sustained phonation</td>
<td>• Appearance of quick, deep inhalation prior to exhalation</td>
<td>SLP Model (visual and auditory), Verbal, auditory, visual, tactile and sensory/motor cues</td>
<td>Immediate and delayed feedback, knowledge of results and knowledge of performance at a moderate level of frequency</td>
<td></td>
</tr>
</tbody>
</table>
Contemporary NDT Practice Model

How do I standardize a practice model that is individualized to each child, their participation restrictions, functional limitations and associated impairments?

Therese McDermott-Winter, CScD, CCC-SLP, C/NDT

Participants

Inclusion criteria:
- Ages 5–16 years
- Diagnoses of spastic and spastic dystonic CP
- GMFCS Levels III–IV (moderate to severe)
- CFCS – II–IV
- Limitations in speech intelligibility
- Ability to imitate single words, phrase and simple sentences

Exclusion criteria:
- Severe/profound cognitive limitations
- Current seizure activity
- Identified vocal fold pathology
- Bilateral moderate/severe hearing loss
- Significant visual impairment

Therese McDermott-Winter, CScD, CCC-SLP, C/NDT

<table>
<thead>
<tr>
<th>Subject Population</th>
<th>Participant 1</th>
<th>Participant 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>5 years, 3 months</td>
<td>5 years, 4 months</td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>CP Classification</td>
<td>Spastic/Dystonic</td>
<td>Spastic/Dystonic</td>
</tr>
<tr>
<td>Gross Motor Function Classification System (GMFCS)</td>
<td>IV</td>
<td>III</td>
</tr>
<tr>
<td>Communication Function Classification System (CFCS)</td>
<td>III–some difficulty with familiar listeners</td>
<td>III–effective sender/receiver with familiar listeners</td>
</tr>
<tr>
<td>Diagnosis of Dysarthria</td>
<td>Yes – Spastic/Dystonic type</td>
<td>Yes – Spastic/Dystonic type</td>
</tr>
<tr>
<td>School Participation</td>
<td>PreKindergarten – preschool/inclusive – half-day program</td>
<td>PreKindergarten – preschool/inclusive – half-day program</td>
</tr>
<tr>
<td>Current Therapies:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Therapy (PT)</td>
<td>One session in pool</td>
<td>Two sessions weekly</td>
</tr>
<tr>
<td>Occupational Therapy (OT)</td>
<td>One session weekly</td>
<td>Two sessions weekly</td>
</tr>
<tr>
<td>Speech Therapy (ST)</td>
<td>One session weekly</td>
<td>Two sessions weekly</td>
</tr>
<tr>
<td>Subject Population</td>
<td>Participant 1</td>
<td>Participant 2</td>
</tr>
<tr>
<td>Use of Oral Motor Strategies</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Oral Motor - Speech/Language</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Methods:

Independent Variable

Contemporary NDT Practice Model – defined

- SLP utilizes direct therapeutic handling and facilitation of movement transitions to enhance speech function.
- Development of treatment protocol based upon common diagnosis, level of function incorporates anticipated single and multi-system impairments.
- Preparation strategies in the NDT model will comprise approximately the first 20 minutes of the session, to be followed by NDT facilitation integrated with the SSA tasks.

NDT RESPIRATORY PHONATORY TREATMENT PROTOCOL

**Sample**

<table>
<thead>
<tr>
<th>Body Structure &amp; Function</th>
<th>Impairment</th>
<th>Strategy</th>
<th>Purpose</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS, NM, S</td>
<td>Range of motion restrictions within the rib cage (ribs to spine, ribs to ribs)</td>
<td>Rib Cage Mobility /Lateral Weight Shift (WS)</td>
<td>Continue to introduce and expand the mobility of the rib cage, and to address the angle of trunk while standing</td>
<td>Immediate and delayed feedback, knowledge of results and knowledge of performance at a moderate level of frequency</td>
</tr>
</tbody>
</table>

**Session Data**
- Sustained vowel duration
- Use of slowed rate of speech
- Appropriate pausing for breath

**Intermittent/Scheduled Data**
- Children’s Speech Intelligibility Measure (CSIM)
- Elicited conversational language sample
- Segmental Assessment of Trunk Mobility (SATCO)
RESULTS

Therese McDermott - Winter, CScD, CCC - SLP, C/NDT

Participan 1: DV1

<table>
<thead>
<tr>
<th>Condition Phase</th>
<th>A</th>
<th>B</th>
<th>A2</th>
<th>BC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition Length</td>
<td>3</td>
<td>7</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Level Median</td>
<td>0.89</td>
<td>1.2</td>
<td>1.25</td>
<td>1.94</td>
</tr>
<tr>
<td>Level Mean</td>
<td>0.84</td>
<td>1.54</td>
<td>1.25</td>
<td>1.78</td>
</tr>
<tr>
<td>Level Range</td>
<td>0.26</td>
<td>1.98</td>
<td>0.7</td>
<td>1.47</td>
</tr>
</tbody>
</table>

Deterioration Envelope

- $0.25 \times 0.89 = \pm 0.22$

% Within Deterioration Envelope

- 100%/Stable
- 43%/Variable
- 50%/Variable
- 34%/Variable

Trend: Direction

- Slight Deceleration/Downward
- Acceleration/Upward
- Deceleration/Downward
- Acceleration/Upward

Level Change:

- Relative
  - 0.05 / deteriorating Downward slope
  - 1.52 / improving Upward slope
  - 0.7 / deteriorating Downward slope
  - 0.93 / improving Upward slope

- Absolute
  - 2.8 / improving Upward slope
  - 2.21 / improving Upward slope

Trend Stability

- 100%/Stable
- 71%/Variable
- 100%/Stable
- 83%/Stable
### PARTICIPANT 1: BETWEEN CONDITION ANALYSIS - DV1

<table>
<thead>
<tr>
<th>Condition</th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Variables Changed</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Change in Trend: Direction Change</td>
<td>Zero</td>
<td>Accelerating to</td>
<td>Accelerating</td>
</tr>
<tr>
<td>Change in Trend: Effect</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
</tr>
<tr>
<td>Change in Trend: Stability</td>
<td>Stable to Variable</td>
<td>Variable to Variable</td>
<td>Variable to Variable</td>
</tr>
<tr>
<td>Change in Level: Relative Change</td>
<td>Deteriorating</td>
<td>Deteriorating</td>
<td>Improving</td>
</tr>
<tr>
<td>Change in Level: Absolute Change</td>
<td>Improving</td>
<td>Deteriorating</td>
<td>Improving</td>
</tr>
<tr>
<td>Change in Level: Median Change</td>
<td>Improving</td>
<td>Deteriorating</td>
<td>Improving</td>
</tr>
<tr>
<td>Change in Level: Mean Change</td>
<td>Improving</td>
<td>Deteriorating</td>
<td>Improving</td>
</tr>
<tr>
<td>Percentage of Non-Overlapping Data (PND)</td>
<td>71%</td>
<td>0%</td>
<td>67%</td>
</tr>
</tbody>
</table>

---

### SPEECH INTELLIGIBILITY - SINGLE WORDS

- **Baseline:**
  - P2 Phase
  - Connected Speech

- **A2 Phase:**
  - Connected Speech

- **BC Phase:**
  - Connected Speech

---

### SPEECH INTELLIGIBILITY CONNECTED SPEECH

- **Baseline:**
  - Connected Speech

- **A2 Phase:**
  - Connected Speech

- **BC Phase:**
  - Connected Speech
DISCUSSION

Purpose: To determine the effectiveness of two different intervention protocols prioritizing treatment of the respiratory system in improving speech intelligibility in children with cerebral palsy

- NDT was combined with the SSA protocol
- Improvement in skills again achieved
- Functional relationship established

Findings of replication of effect across three phases of the investigation support a conclusion of a functional relationship between IVs and DVs.

Across all phases of the investigation
- Change in trend direction (accelerating) with the removal of the intervention
- Accelerating trend in direction with intervention

Lack of an abrupt change in direction, but anticipated

- Severity of diagnosis
- Motor learning aspects of the task
Both P1 and P2 demonstrated strong atypical compensatory patterns to maintain upright positions against gravity.

- P1 > P2

Scoring did not change significantly until completion of the BC phase.

### Speech Intelligibility - Phase Comparison

<table>
<thead>
<tr>
<th></th>
<th>P1 - B Phase</th>
<th>P1 - BC Phase</th>
<th>Variance</th>
<th>P2 - B Phase</th>
<th>P2 - BC Phase</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Word Speech Intelligibility</td>
<td>64.6%</td>
<td>79.3%</td>
<td>+14.7%</td>
<td>66%</td>
<td>79.5%</td>
<td>+13.5%</td>
</tr>
<tr>
<td>Connected Speech Intelligibility</td>
<td>61.4%</td>
<td>70.6%</td>
<td>+9.2%</td>
<td>92%</td>
<td>91.5%</td>
<td>+0.5%</td>
</tr>
</tbody>
</table>

### SATCo

- Both P1 and P2 demonstrated strong atypical compensatory patterns to maintain upright positions against gravity.
  - P1 > P2
- Scoring did not change significantly until completion of the BC phase.

### Investigator/Year

<table>
<thead>
<tr>
<th>Investigator/Year</th>
<th>Increased Single Word Intelligibility</th>
<th>Increased Intelligibility of Connected Speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>McDermott, Winter, 2018</td>
<td>0 - 16%</td>
<td>14.5 - 20%</td>
</tr>
<tr>
<td>Boliek &amp; Fox, 2016</td>
<td>0 - 16%</td>
<td>Not Reported</td>
</tr>
<tr>
<td>Pennington et al., 2010</td>
<td>0 - 15%</td>
<td>10.8 - 14.7%</td>
</tr>
<tr>
<td>Fox &amp; Boliek, 2014</td>
<td>Not Reported</td>
<td>No Change</td>
</tr>
<tr>
<td>Pennington et al., 2018</td>
<td>Not Reported</td>
<td>No Change</td>
</tr>
<tr>
<td>Solomon, McKee &amp; Garcia-Berry, 2001</td>
<td>-0.8%</td>
<td>11.2%</td>
</tr>
</tbody>
</table>

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Limitations

◦ Small number of participants
◦ Age of participants
◦ Sequence of investigation phases
◦ Lack of control group
◦ Instrumentation

Conclusion

Connected speech intelligibility - Treatment implementing the NDTA Contemporary Practice Model™ was more effective.

Changes in trunk control (SATCO) were paired with improvement in connected speech intelligibility.
What led me to do the research?

Since 2012-66% of clinicians are now referencing research in peer-reviewed journals to support clinical decision making.

(Fell DW, Burnham, JF, Dockery, JM. Determining where physical therapists get information to support clinical practice decisions. Health Inf and Lib Journal 2013: 30 (1): 35-48.)

Why was this specific research needed?

What was the question?

Critical aspects to explore:

- Parents perceptions
- Intensity of intervention
- NDT (ICF)
- Specific goal-driven intervention (used Goal Attainment Scaling: GAS)
Specific Aims:

Aim #1: To examine parents’ perspectives regarding their child’s participation in an intensive NDT program using direct interviews.

Research Question 1 (qualitative design): “What has having your child participate in this intensive neurodevelopmental treatment program been like for your family and you as parents of a child with a disability?”

Aim #2: To investigate if there is a significant difference in functional skills after an intensive NDT program with therapeutic handling measured by the GAS and the COPM in children with cerebral palsy (CP) and other neuromotor disorders ages 1-17.

Research Question 2 (quantitative design): Is there a significant change in functional skills as measured by the GAS and the COPM in children with CP and other neuromotor disorders after receiving a short-term intensive program of NDT therapeutic handling?

Research Design: Mixed Method

Qualitative: Parent Interviews (n=13)
Quantitative: GAS and COPM (n=16; subjects: 1-17 years of age)

Distribution of GMFCS Levels of Children:

<table>
<thead>
<tr>
<th>GMFCS Level</th>
<th># of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>4</td>
</tr>
<tr>
<td>IV</td>
<td>5</td>
</tr>
<tr>
<td>V</td>
<td>4</td>
</tr>
</tbody>
</table>

Intervention:

Direct handling using NDT protocol (appendix)
Intensity was 2-4 hours per day for a 1 or 2 week duration
Therapists were experienced NDT certified/trained therapists and instructors
Training provided on NDT protocol and goal writing using GAS

Instrumentation: Quantitative

Quasi-experimental, repeated measure design
- Goal Attainment Scale (GAS)
  Scale ranges: -2 to +2
- Canadian Occupational Performance Measure (COPM)
  Scale ranges: 1 to 10 (Importance, Performance, Satisfaction)

(Kirsuk et al., 1994; Law et al., 2005)
Final Results: Quantitative
Comparing Pre- to Post-intervention scores using GAS and COPM
Statistical Significance (set a priori > .05)
- GAS p < .001
- COPM p < .001

Final Results: Qualitative
Themes identified as critical to children’s intensive therapy program:
1.) Positive effects were seen with increased intensity of therapy.
2.) Expert, compassionate therapists were valued.
3.) Team collaboration was vital.
4.) Objective, realistic goals were required.
5.) Home programs with teaching were needed.
6.) Funding and scheduling were challenging.
7.) Children and their families had individualized needs.

Theme 2. Unique qualities of the therapists such as expertise, being a good teacher, having compassion, good listening skills and providing hope were essential keys to the success of the intensive program for caregivers.

The therapists were passionate about what they do and provided hope for families

"Again it comes back to the fact that everybody that is involved with this program is just as passionate as we are about seeing these kids succeed in everything they can. So it is nice to know that they’re not here because it’s their 9 to 5 job, this is what they do to put food on the table... they’re doing this because they’re passionate about it and I think that the kids and the parents pick up on that. You know that they enjoy what they’re doing." (Caregiver of A.)

"To me it’s nice to get that kind of positive voice because you know, sometimes we don’t always get that kind of positive message from physicians or people that see him... we know that there’s a risk, but I’ve realized from that it changes a parent’s perspective to be told a negative thing... and then the parent’s lower their expectations." (Caregiver of D.)
Clinical Implications
- Assist parents with making decisions regarding intervention intensity for their children
- Therapists include options of intensive intervention in the clinical setting
- Writing SMART goals:
  S=specific
  M=measurable
  A=achievable
  R=realistic/relevant
  T=timed
- Collaboration recommended
- Operationally define “intensive” with greater emphasis on total intervention time
- Home programming (parents liked pictures/videos of children/text)
- Therapists viewed by parents as experts and compassionate

(SMART goals: Bovend’Eerdt et al., 2009; Mailloux et al., 2007)

Limitations of the study:
- Small sample size (n=16) for quantitative design
- Convenience sample was used (one geographical location so ↓ diversity in parents interviewed and their children)
- Short period of time for intervention with no F/U of goal attainment
- ↓ control of variables (ages: 1 to 17 years, no control over past medical procedures, no blinding/randomization)
- Varying length of time of the NDT intervention ranging from 2-4 hours a day (1/2 days vs. full days, respectively).

Appendix: Neurodevelopmental Treatment Protocol:

The treatment used in this study consists of handling techniques learned by experienced pediatric clinicians in an NDTA basic pediatric certification course. Physical, occupational or speech therapists completing the basic NDT/Bobath pediatric certificate course consisting of 261 contact hours served as treating therapists in this study. (Please refer to Table 5 for further course information)

Therapists treating children in the intensive NDT program followed the following treatment protocol:

1. Therapists need to complete a thorough evaluation of each client specifically analyzing effective and ineffective posture and movement behaviors and systems review of each participant. Systems to be evaluated include: neurosensory, musculoskeletal, cardiovascular, respiratory, sensory (visual, auditory, tactile, proprioceptive, and vestibular), gastrointestinal, and integumentary.
2. Functional goals are written collaboratively with parents, child (if applicable) and therapists treating participant. Goals are written prior to session interventions and using the Goal Attainment Scale format (5 point Likert scale).
3. Individualized direct handling is used with each participant with the therapist using their hands on the child with appropriate key points of control (e.g. pelvis, trunk and shoulder girdle, upper and lower extremities).
Neurodevelopmental Treatment Protocol:

4. Preparatory activities (such as somatosensory preparation, addressing appropriate arousal level, and trust building/rapport with parents and child) are included in the initial 1/3 of the session and continued as needed throughout session.

5. Alignment, base of support, and center of mass (ABCs) are addressed during each treatment session. Each child is assisted throughout the treatment session with active alignment, weight shifting their center of mass over their base of support with transitional movements.

6. Core muscle activation including flexion with rotation or extension rotation (or both if needed) is facilitated.

7. Elongation of muscles if needed followed by activation activities to maintain elongation is performed.

8. Problem solving throughout the treatment session occurs, modifying handling as needed to support functional outcome(s).

9. Practice time and repetition of functional outcome using both simulated and real practice of skill is completed with each session.

10. Team collaboration (including therapists, parent and child) is ongoing and occurs with all sessions.
An Randomized Controlled Clinical Trial to Assess the Efficacy of an NDT Intervention to Improve Postural and Selective Control In High-Risk Preterm Infants

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Statement of Interests

G. L. Girolami is a partner in Infant Motor Performance Scales, LLC, the publisher of the Test of Infant Motor Performance, the Test of Infant Motor Performance Screening Items, and the Harris Infant Neuromotor Test.

Three Pillars of Evidence

"the integration of best research evidence with clinical expertise and patient values."

(Sackett 2000)
Background

Aim:
To validate the efficacy of an NDT ‘Baby Treatment’ intervention protocol to improve postural and selective control in high risk preterm infants.

Evidence Based Practice

Research Evidence

Patient Values

NDT Infant RX provides a rationale for Rx of high-risk preterm infants

Research supports the efficacy NDT to change motor performance in high-risk infants

Research supports the efficacy of NDT based items on the TIMPv1

Further research validates the efficacy and value of clinical expertise

Research supports validity and reliability of revised and item amplified TIMP

Methods

• Randomized controlled clinical trial
• Inclusion criteria developed to isolate high risk group of preterm infants
  • AGA; BW < 1800 grams; PCA at birth < 35 wks
  • Min of 3 risk factors: 5 min Apgar <5; IVH; seizures; BW<1000g; irritability or CNS depression; asphyxia; thermal instability mechanical vent; RDS; resp arrests
• Pretesting using NBAS
  • 34 – 35 wks
  • At least 3 abnormal or asymmetrical reflexes
  • Recruited to participate
**Methods**

- Children Randomly assigned to groups
  - PT - preterm treatment group (n=9)
  - x = 4.3 medical complications
  - PC - preterm control group (n=10)
  - x = 3.7 medical complications
- TC – full term control group (n=8)

**Study Design**

- Preterm Treatment vs. Preterm Control Groups
  - NDT Intervention vs. passive handling protocol (12 – 15 min/day)
  - Rx initiated during 34th or 35th PC week
  - 14 – 28 treatments
  - Over 7 – 17 days
  - D/C Rx: bradycardia, tachycardia, resp prob, apnea or excessive crying
- Term infants – no intervention; testing only

Post-testing (NBAS & TIMP v.1)

- Evaluators blinded to group assignment
- Preterm infants tested within 72 hours of protocol completion
- Term infants tested 1 day after birth

**Functional Goals**

- Upright head control in supported sitting
- Head lifting and turning in prone
- Hands to mouth in sidelying
- Midline head in supine
- Lift and hold arms and legs vs. gravity in supine
RESULTS OF THE CLINICAL TRIAL

• A group of preterm infants (n=9) treated with an NDT based intervention had significantly higher scores on the pilot version of the TIMP than an untreated preterm control group (n=10) (p<= .001).

• The treated preterm infants has similar functional scores demonstrating motor performance similar to the full term control infants (n=8).

• No impact on physiological stability or weight gain.

Girolami & Campbell, Pediatr. PT. 1994

Scores on Observed Items

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Scores on Elicited Items

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G. L. Girolami, PT, PhD  Do not reproduce without permission of the author
Conclusions

- An active handling intervention using principles of NDT Baby Treatment can improve spontaneous and elicited postural control
- Postural control of the treated high risk preterm infants was similar to that of full-term low risk infants
- Physiological status and weight gain were not compromised
- Other studies have adapted the intervention protocol with similar results

Limitations

- Small Sample
- Lacks long term follow up
Parents are often
- Unprepared
- Insecure
- Vulnerable


From the NICU to home:
Increased parental responsibility

- Intervention between 34 – 37 weeks PMA
- 10 minutes X 2 each day X 3 weeks
- Attention to infant’s response and state
- Parents could select the time to administer the intervention
- Parents recorded the duration of each intervention

Short-term outcome

The intervention improved short-term motor performance on the TIMP at term (37 weeks)

Ustad, Óberg, Girolami et al., Pediatrics 2016

Parents in the intervention group described increased attachment to their infant and felt empowered as a parent at term age and 3 months post-term.

(Óberg, Girolami, et al, 2018)
Qualitative Study: Parent Quote

"It was very nice......to interact with my own baby, not just sitting with her in my lap with all those tubes as my only experience......I could see that she was more than that and it was not dangerous to move her ... She was a baby. She became more like MY BABY.... (1:3)"

Oberg, Girolami et al. European Journal of Physiotherapy, 2018

Evidence Based Practice
Clinical Observation
Research Evidence
Patient Values

NDT Infant RX provides a rationale for Rx of high-risk preterm infants
Research supports the efficacy to change motor performance in high-risk infants
Research supports validity and reliability of revised and item-amplified TIMP
Research supports the efficacy of NDT based items on the TIMPv1
Further research validates the efficacy and value of clinical expertise

Thank you!