Therapeutic Recreation for the Frail Elderly: A New Approach

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Introduction

The Neuro-Developmental Sequencing Program (NDSP) is a new theory and method of treatment for the regressed elderly. It utilizes a developmental approach and adaptive equipment as a method to promote movement. The NDSP was originated in January 1987 as a treatment method for geriatric therapeutic recreation at Willard Psychiatric Center. Although this program began in therapeutic recreation, it has since become interdisciplinary: Occupational Therapy (OT), Physical Therapy (PT) and nursing are using this now as a basis for treatment as well.

The first evidence of success was improvement in strength, flexibility and ambulation. (Original research article, "Utilizing a Developmental Approach and Adapted Equipment in Therapeutic Recreation for the Regressed Elderly," in *Therapeutic Recreation Journal*, 3rd quarter, 1988.) When OT and nursing became involved a year later, measurable improvements also were noted in activities of daily living, reduction of falls and in community living skills. Data are being gathered on an ongoing basis to test the long-term effects of this new method of treatment. Surprisingly, we found that even in these very old chronically mentally ill patients (the average age is 85 and many had been hospitalized for over 50 years), significant improvements continue to occur.

The Theory

While the Neuro-Developmental Sequencing Program (NDSP) was being conceived, it was noted that movement and functional losses in patients occurred in approximately the reverse order of their original development. Nolen discovered similar results on 152 late-stage dementia patients on the MMS (*Occupational Therapy Journal*, October 1988, #10). Develop-
mental theory of treatment and rehabilitation was applied to the regressed elderly population in an age-stage appropriate manner to improve their functional ability through changes in the nervous system as opposed to skills training, which was used in the past. A flow chart (Maturation/Atrophy Chart - Figure 2) has been explicated to indicate how the neurological changes of the elderly coincide with the developmental stages of the child. The first three columns of the chart explain, according to Fiorentino, the order in which the nervous system develops. The last three columns describe the pattern in which the geriatric population lose developmental milestones achieved in childhood. The middle column describes common characteristics between the two populations.

Before patients begin this program, they are assessed and placed in a developmental stage (either stage 1, 2 or 3) according to their functional losses. These assigned stages aid the therapist with proper positioning and treatment to be used. (See Figure 1.)

### Stage 1

It appears that the cortex is the first aspect of the central nervous system (CNS) to exhibit atrophic signs of aging. Patients assessed as stage 1 in our program show decreased equilibrium reactions. This results in a wide irregular gait that may be experienced as a need for support in walking. These patients also show an increase in the incidents of falls. They are able to stand alone, but their equilibrium reactions...
show definite retardation. Stair climbing for these individuals becomes difficult. Their endurance levels have decreased and overhead movements require more effort. They also return to underhand patterns to throw objects. They show decreased dexterity as evidenced by changes in their mature grasp, and as demonstrated by their preference for a gross grasp, as opposed to a three point grasp, for writing and eating.

Cognitive skills that need to be maintained at this stage include being able to follow two- or three-step verbal directions. Patients in stage 1 are able to make leisure choices. But their awareness of leisure is basically knowing what leisure activities are available and when and where the programs are held.

Physiologically, in stage 1 patients there is a reduction of brain weight of 10-20%. Most of the atrophy occurs in the cortex. There is calcification of the meninges and a reduced blood flow of approximately 20%. Peripheral nerves are reduced by one-third. By the time this much atrophy has occurred, patients are not usually candidates for traditional therapeutic recreation programs. On the therapeutic recreation model of care, this is where our active treatment interventions begin.

**Stage 2**

The second stage of aging shows changes in the functioning of the midbrain. This area of the brain is responsible for righting reactions. These patients have difficulty putting their bodies in position to actively manipulate their environment. Stage 2 patients in our program have poor sitting balance and may require assistance to change position. There is also a significant deficit in upper extremity range of motion. During activities these patients are reluctant to cross the midline of their body. They predominately use a palmar grasp to handle small objects. Stage 2 patients prefer to explore objects orally instead of manually to provide their sensory systems with the appropriate information.

Patients in this stage are able to visually track objects, but less than 180 degrees.

Level 2 patients can initiate familiar one-two step repetitive action oriented activities to reinforce the relationship between their actions and the effects. These patients display accurate adaptive responses to sensory input at the brain stem and midbrain level.

Patients in this stage require assistance in all self-care activities, but are still able to complete leisure time activities with frequent verbal and tactile prompting, and to make simple leisure choices.

**Stage 3**

In the last stage of the NDSP there is a release of primitive reflexes from cortical inhibition i.e. asymmetrical tonic neck reflex, symmetrical tonic neck reflex, moro reflex, rooting and sucking reflexes. Patients return to a fetal position and lose head control. There is the return of the palmar reflex. Movement at this stage is symmetrical, random and involuntary. The patients are only able to attend to objects at the midline and for brief periods of time. At this level of aging the patients are dependent in all aspects of self care. Patients' homeostatic mechanisms are irregular and swallowing and peristaltic activities are not coordinated.

At this level patients work on improving base level skills (self awareness, eye contact and response to internal and external stimuli). They require physical and verbal assistance and demonstrated directions to complete simple one-step tasks. Assisted gross motor movement with adequate support and reflex inhibiting postures is necessary.

**Therapy Principles**

The following treatment principles are adhered to during all therapy sessions: Proper positioning at each stage is important to inhibit
Figure 2. Maturation/Atrophy Chart (Reprinted with permission from Therapeutic Recreation Journal 3rd quarter, 1988.)

<table>
<thead>
<tr>
<th>Levels of Maturation (or Atrophy)</th>
<th>Corresponding Reflexes</th>
<th>Resulting Position to Work From</th>
<th>Effect on Childhood/Development</th>
<th>Gross Motor</th>
<th>Fine Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinal and/or Brain Stem</td>
<td>(Apical) Primitive Reflexes</td>
<td>Prone or Supine Lying</td>
<td>Symmetrical-random movements</td>
<td>Tight hand grasp</td>
<td>Eyes open to midline (head is away)</td>
</tr>
<tr>
<td>Mid Brain</td>
<td>(Quadrupedal) Righting Reactions</td>
<td>Crawling or Sitting</td>
<td>Pronated position</td>
<td>Gaiting head control</td>
<td>Eyes open to 45 degrees</td>
</tr>
<tr>
<td>Cortical</td>
<td>(Biapical) Equilibrium Reactions</td>
<td>Standing or Walking</td>
<td>Can put self in sitting posture</td>
<td>Standing with support</td>
<td>Requires assistance for fine motor control</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Levels of Maturation (or Atrophy)</th>
<th>Common Characteristics</th>
<th>Atrophic Effects of Aging</th>
<th>Principles to Follow in Activity Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinal and/or Brain Stem</td>
<td>Requires Total Care</td>
<td>Head lag</td>
<td>1. Begin in supine—supported position</td>
</tr>
<tr>
<td></td>
<td>Vestibular activities are irregular</td>
<td>Fetal position (side or supine—stabilized frame)</td>
<td>2. Provide sensory simulation to attain awareness</td>
</tr>
<tr>
<td></td>
<td>Respiratory</td>
<td>Loss of balance reflex</td>
<td>3. Passively stretch limbs to create—bilateral symmetry and prone to sit</td>
</tr>
<tr>
<td></td>
<td>Body Temperature</td>
<td>Return of some primitive reflexes</td>
<td>4. Move to sitting position (be seated on floor) with access reaching activity</td>
</tr>
<tr>
<td></td>
<td>Swallowing &amp; respiratory activities not coordinated</td>
<td>ATM* or STNR</td>
<td>5. Stand, bear weight</td>
</tr>
</tbody>
</table>

Mid Brain

<table>
<thead>
<tr>
<th>Requires Footing</th>
<th>Bathing</th>
<th>Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positioning</td>
<td>Pelvic movements of spine, head usually intact or parallel</td>
<td>May return to Palmer Grip</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Loss of U.E. &amp; ROM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Standing posture</td>
</tr>
</tbody>
</table>

Cortical

<table>
<thead>
<tr>
<th>Brain weight increases</th>
<th>Central canal last to develop</th>
<th>Increased blood flow to head and neck</th>
<th>Overhead movements more difficult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progressive integration</td>
<td>Reduction in brain weight 10-20%</td>
<td>Reduced blood flow 20-30%</td>
<td>Overhead movements more difficult</td>
</tr>
<tr>
<td>Reduced blood flow 20%</td>
<td>Reduced blood flow 20%</td>
<td>Overhead movements more difficult</td>
<td>Overhead movements more difficult</td>
</tr>
</tbody>
</table>

1. Maturation levels flow from the top of the chart to the bottom (as indicated by the arrows).
2. Atrophy levels flow from bottom to top of the chart (as indicated by the arrows).
3. From these apical matrices (Pinebottom, 1972), Reproduced with permission of the author.
4. ATM = asymmetrical tonic neck reflex; STNR = symmetrical tonic neck reflex; U.E. = upper extremity; L.E. = lower extremity.

abnormal movement and facilitate volitional movement at the proper stages of development. During activities, beginning and ending body positions are incorporated that coincide with the patient's level of functioning.
Since development proceeds in a head to tail direction and from the midline of the body outward, therapy is begun with a sensory experience involving the head-neck, eye, ear or mouth to attain alertness. Patients are then provided the opportunities to control large postural muscles enabling him or her to lift the head, support the body and change positions. Exercises begin with head-neck control activities and proceed cephalocaudal and proximal to distal. Patients must develop proximal muscles to provide stability to move distally.

Patients need to change positions frequently in this program, about every twenty minutes. They should be given plenty of opportunities for movement from these positions.

Because bilateral movement precedes unilateral movement developmentally bilateral exercises are provided prior to the introduction of unilateral activities.

Abundant sensory experiences are provided from a variety of modalities (sights, tastes, sounds and textures) to prevent sensory deprivation and to facilitate adequate sensory processing.

Program Components

At level 1 of aging, patients ambulate to programs and position themselves in a comfortable position (may stand or sit). If they begin the program sitting they end the program with standing activities. The group discusses and reminiscences about objects passed around the group. There are slow gross motor, balance, fine motor and cognitive activities all adapted to meet patient-specific treatment objectives. At the end of the program patients ambulate back to their units.

Level 2 patients wheel themselves to programs to begin their treatment, then transfer to equipment and are positioned in a supported sitting position. They are provided with sensory stimulation to attain alertness. Slow gross motor activities are completed first as active assistive exercises and then as progressive resistive exercises. A gross motor game is used to improve head control, eye-hand coordination and upper extremity functioning. Patients stand and ambulate back to their units with staff assistance.

Level 3 patients begin their therapy sessions in a supported supine position. They are gently rocked and are provided with familiar sensory stimulation to increase awareness of themselves and the environment. Exercises are completed passively from head to feet, bilaterally and proximally to distally. Patients are then placed in a supported sitting position, which inhibits primitive reflexes, and are actively presented with objects to promote purposeful reaching and active weight shifts. At the end of each program patients are given the opportunity to bear weight in their lower extremities.

Adaptive Equipment

The equipment used in this program consists of a ⅝ dowel for range of motion and progressive resistive exercises, free weights, therabands and tethered beach balls. The sensory air flow mat encourages gross motor movement as well as relaxation while providing sensory stimulation. The vestibular donut is a 4’ tall donut-shaped mat that is used to give support to patients as they stand or are rocked. A sensory motor stimulation box is an electronic therapy tool to maintain, restore or develop the basic functions of the upper extremities and to provide visual, auditory and tactile stimulation. A large bolster and vestibular board are used to facilitate higher level righting reactions and equilibrium responses. A vibrator is used for tactile and proprioceptive input.

All patient programs are designed in a hierarchical fashion. Patients are able to progress to higher level programs as their skills develop. An example of this progression of
programs can be found on the NDSP Hierarchy Chart.

Findings

Data have been gathered over the past two and one-half years and patients have demonstrated significant improvements in strength, flexibility, ambulation and functional abilities.

Flexibility was tested with an adapted sit-and-reach test. This piece of equipment is used to measure trunk and hip-forward flexibility for wheelchair bound and regressed patients. The patients sit in a chair with their feet against the vertical support, knees straight and reaching downward while pushing the slide bar with their fingertips. The scale was read at the farthest point, to the nearest half inch. Patients are "warmed-up" before testing and two trials are given. The best score is recorded. The average flexibility of the patients in the program was 8.61 (pretest) and is now 12.68 (post test) (significant at .01 level).

Strength is measured by hand-held or strap-on free weights lifted from the lap to the chin, and measured in pounds. Each hand is tested separately while the other hand rests on the chair arm rest. Two trials are given and the best score is recorded for each hand. The average strength on the right was 2.9 (pretest) and is now 7.07 post-test). The average strength on the left was 2.6 (pre-test) and now is 6.72 (post-test).

Ambulation is measured in the following manner. Each patient is allowed to relax in a supine position on the sensory air flow mat for 5-10 minutes (this provides an opportunity to experience sensory input and to stretch out before walking). Then the patients are asked to walk (with minimal assistance if necessary) until they fatigue. The distance is measured and recorded. Two trials are given on two separate days and the best score is recorded. The average distance the patients were able to ambulate was 28.6 feet (pre-test) and now is 52.2 feet (post-test). Also, prior to NDSP, we had 16 patients who ambulated independently (no assistive devices). This has now grown to 41 patients in 1989.

Prior to the initiation of the Falls Prevention aspect of the NDSP (September 1988) there was an average of 40 falls per month in the regressed geriatric unit. After this program was carried out for 12 months the average has decreased to seven falls per month in this service. This is a 76% improvement.

Functional skills have been measured using a modified version of the Adapted Behavioral Scale and objective progress reports on patients' level of performance in programs. Four different areas show improved patient performance: self care, cognition, emotional state and placement level of patients.

In the area of self-care, the outcome data were gathered for feeding skills and associated behaviors. This is because self feeding is the first skill gained and the last stage lost in developmental models. As with falls, it also presents a higher risk intervention. We monitored 20 patients since July 1988 and 16 (80%) demonstrated improvement by meeting one or more objectives as scored by using the modified version of the Adaptive Behavior Scale.

In the cognitive domain the outcome data relate to three areas that demonstrate improved behavior. The first area examined was alertness levels. An alert, aware patient was judged as one who could engage in the program tasks and make simple choices (as opposed to being a passive participant such as a movie playing in the room). Pre-NDSP, there were five patients who demonstrated this ability. Thirty-nine patients now can do this. The third area looked at was the patient's ability to handle their money to make purchases at the hospital's community.
store or in the community. This grew from zero patients at the beginning of 1987 to 50 in 1989.

In the affective domain, social recreation participation data were gathered. Pre-NDSP there were ten patients (9%) who were able to state and make a choice regarding leisure activities. This has now increased to 30 patients (18%). We had ten patients (9%) whose social/emotional behavior allowed for meaningful trips into the community. This has now increased to 48 for a 29% improvement.

Our last area of outcome data is placement in the community. During 1987-89 we had nine patients placed in family care. In addition there was one patient placed in a community residence and twelve in nursing homes. Three patients are presently attending the Transitional Groups which take place in our outpatient sites. Six patients are currently being screened in our Little House Program (placement level assessment program). For our patients, their functional ability assessed in this program determines whether we pursue family care or a health related facility. This is close to a 100% increase over prior years.

The NDSP is the focal point for psychiatric/physical rehabilitation approach to our geriatric patients. In closing, this program has provided long term institutionalized patients the opportunity for an "alternative way out." It has helped to prepare our very regressed psychiatric patients to determine their own destinies.