Exploring Sensory Integrative Dysfunction in Process Schizophrenia

(mental health, assessment, theory validation)

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During a 6-week period, the effects of sensory integrative activities on a group of seven chronic nonparanoid schizophrenic adults were compared to the effects of sedentary activities in a control group of seven similar subjects. The effects of each therapeutic approach were evaluated by measuring the patients’ performance in several areas using the Nurses Observation Scale of Inpatient Evaluation-30 (NOSIE-30), the Object Manipulation Speed Test, a gait analysis, and grip strength. The results indicated general improvement in the experimental group. Behaviors measured by the NOSIE-30 showed the most significant improvements. The control group showed isolated improvements in grooming (measured by the NOSIE-30) and in right-hand use (measured by the Object Manipulation Speed Test). These findings suggest that 6 weeks of sensory integrative activities can improve the overall functioning of chronic nonparanoid schizophrenic patients, facilitate their adaptive responses, and enable them to participate more fully in other areas of therapeutic intervention.

The stable group of residents found today in most large psychiatric hospitals is a chronic population. Statistics indicate that approximately half of these are diagnosed as schizophrenic (1). According to King (2) and others (3, 4), the process schizophrenic patient group has traditionally made up a large portion of the chronically hospitalized population. The premorbid status of these patients is poor. Little change in their overall functioning is reported when medication and traditional treatment programs are prescribed. Programs designed for more acute populations fail to make a significant difference when carried out with this chronic group. Therefore,
new directions in therapy are being sought in an attempt to meet the needs of these patients.

One approach that occupational therapists are beginning to use in these settings is based upon King’s theory of sensory integrative dysfunction in nonparanoid reactive and process schizophrenic patients (2). Her theory proposes defective proprioceptive feedback mechanisms, with the vestibular component in particular being both under-reactive and under-active. This results in poor sub-cortical integration of sensory stimuli and inadequate feedback information necessary for normal development of all other perceptual-motor systems. This hypothesis is supported by studies that have identified abnormal vestibular reactivity in the schizophrenic individual (5-11) and by empirical observations of posture, movements, muscle tone, and general behavior in the nonparanoid schizophrenic patient population.

Review of the Literature
Since the publication of King’s article in 1974, several individuals have explored various specific aspects of dysfunction associated with both reactive and process schizophrenia. Huddleston (12) studied the differences in process and reactive schizophrenia as measured by vestibular reactivity, grasp strength, and posture. Her results indicated that, unlike reactive schizophrenics, process schizophrenics have a significantly depressed response to vestibular stimulation. Thus, vestibular reactivity was identified as a criterion for differentiating between these two groups.

Bailey (13) examined the effects of vestibular stimulation on verbalization and speech patterns in chronic nonparanoid schizophrenics. Her study indicates that the quality of language improved following 8 weeks of vestibular stimulation. A control group of similar subjects showed no improvement from participation in more sedentary group activities.

Three additional studies explored other specific aspects of sensory integrative dysfunction in the schizophrenic population, including movement and postural abnormalities (14), postural and reflex integration (15), and the effects of institutionalization on posture (16). However, these studies did not delineate the process or the reactive subgroups. Subjects were chosen on criteria such as chronicity (14), reported presence or absence of delusions (15), and years of institutionalization (16). Because of the failure to select only patients who matched previously established criteria for nonparanoid process or reactive schizophrenia (2, 17-23), these studies neither support nor reject King’s theory.

These studies represent an initial attempt to explore the theory of sensory integrative dysfunction in the schizophrenic population. Additional research is needed in order to evaluate the theory and to establish guidelines for appropriate patient selection in sensory integrative treatment programs in occupational therapy.

Hypothesis
In this study the effects of a sensory integrative therapy program in a process schizophrenic population were compared with the effects of a more traditional occupational therapy program focusing on sedentary activities. The following hypothesis was tested: Sensory integrative treatment techniques in a chronic, adult process schizophrenic patient group will produce more improvement than sedentary treatment techniques in the patients’ adaptive responses, as measured by improved posture and gait, decreased psychomotor retardation, and normalization of behavior in general.

The following definitions were used:

Process schizophrenia—a history of developmental difficulties since childhood with no clear precipitating psychotic incident leading to initial hospitalization.

Chronic—1 year of continuous hospitalization before the study, with multiple previous hospitalizations.

Sensory integrative treatment—activities, previously described by King (2) and Ayres (24), that are subcortical in nature and stimulate the vestibular, auditory, proprioceptive, tactile, visual, and olfactory systems. Primary emphasis for activities chosen in this study was given to those that stimulate the vestibular, proprioceptive, tactile, and auditory systems.

Sedentary occupational therapy treatment—table activities that are cortically controlled and focus on arts, crafts, grooming, and table games.

Methodology
Subjects. Fourteen chronic, nonparanoid, process schizophrenic adults residing in a North Carolina state psychiatric hospital were subjects for this study. All met the physical criteria previously identified in process schizophrenia by King (2): 1. a pronounced head-to-toe S-shaped curved posture; 2. a shuffling gait with an apparent inability to lift the feet and walk with a normal heel-toe pattern; 3. an inability to raise the arms above the head to anything approaching a vertical line; 4. immobility of the head and shoulder girdle, manifested by an inability to rotate the
head on a vertical axis; 5. a tendency to hold the arms and legs in a flexed and internally rotated position; 6. a lack of normal hand function and an abnormal resting hand position that involves the thumb held in adduction, atrophy of thenar eminence, and ulnar deviation of the wrist.

The subjects were selected from approximately 60 chronic patients, 30 of whom met the criteria for process schizophrenia and displayed the physical characteristics mentioned above. Of this group, ward personnel considered 16 to be cooperative and physically capable of participating in the study. All 16 agreed to participate; however, 2 failed to do so initially and were dropped, leaving a total of 14. The 14 subjects had been hospitalized an average of 18 years, with a range of from 6 to 30 years. Patients were randomly assigned to the experimental group or the control group. The average age of the experimental group was 39 years (range 23 to 48); of the control group, 40 years (range 30 to 59). There were five females and two males in the experimental group, three females and four males in the control group. All control group subjects were right handed. In the experimental group three subjects were left handed, and four were right handed. Average attendance in the experimental group was 25 days, in the control group, 30 days.

All subjects were on medication. One patient in the experimental group had her medication increased during the study period. However, her post-test scores did not appear to be significantly affected. All subjects showed little interest in previously offered therapeutic activities (music, recreation, occupational therapy).

Assessment. A 2-week baseline period was conducted, with both groups receiving sedentary occupational therapy activities for 1 hour per day. During this time, patients were also individually evaluated by the investigators as follows: 1. Grip strength was measured bimanually with an adjustable hydraulic hand dynamometer. An average of three measurements was recorded. 2. Gait was evaluated with an informal assessment devised by the hospital's physical therapist. Routine factors were assigned a score of 0-1 point with a total possible score of 11. Ability to dorsiflex, walk with a normal heel-to-toe pattern, correct leg stride, arm swing, balance, length of stride, joint mobility, stepping sideways, and walking on a variety of surfaces are examples of factors evaluated. 3. Psychomotor retardation was evaluated with The Object Manipulation Speed Test (25), a tool designed specifically to measure psychomotorility in the psychiatric population.

During the first week of the baseline period, patients were also evaluated by hospital ward staff who used the Nurses Observation Scale of Inpatient Evaluation (NOSIE-30) (26). This tool consists of 30 statements that describe an individual's behavior during the last 3 days. Ward staff had been trained in its use previously by the staff psychologist and, hence, were familiar with it. This was carried out as a blind evaluation. A composite score, based upon seven subtotal scores, provides an index of the patient's functioning in the areas of social competence, social interest, personal neatness, depression, irritability, and manifest psychosis, with four remaining miscellaneous factors. Results were scored according to the formula adopted by the Clinical Research Unit for hospitalwide research projects. A decrease in post-test scores indicates improvement in function.

At the end of the baseline period, only four patients from the experimental group and three patients from the control group agreed to be videotaped. Ability to raise the arms vertically above the head, till the head backwards, rotate the head, throw and catch a ball, hop, skip, jump, manipulate small objects (pincer vs lateral grasp), cross the midline, balance on one foot, and perform Schilder's Arm Extension Test are examples of activities recorded.

Each day following the treatment periods, staff members in both groups recorded clinical observations of each individual patient. This was done to record daily behavioral changes, to note particular activities that patients either did or did not like, and to provide data that might indicate trends or patterns leading to effective treatment. Seventeen questions that assessed general behavior, appearance, and movement were answered yes or no for each subject. Individual comments were added as appropriate.

At the end of the 6-week period, all assessments were rereadministered, including the videotaping.

Procedure. This study was originally designed to cover a 3-month period of intervention; however, because of a hospital wide reorganization, all patients were reclassified and relocated to different residential buildings, and all patient treatment was temporarily suspended except for medications. Therefore, the study was terminated after 6 weeks of intervention when the relocation process began.

The treatment sessions were conducted by six staff members, two of whom were back-up personnel and were not present every day. In the experimental group there were two
therapists and one technician 1 day per week; one therapist with one technician, 4 days per week. In the control group, there were one therapist and one technician, 5 days per week.

The control group continued to receive the sedentary occupational therapy treatment techniques for 1 hour per day. The experimental group received a wide variety of sensory integrative activities that focused on vestibular, proprioceptive, tactile, and auditory stimulation. These activities were conducted in a noncompetitive atmosphere that emphasized fun, play, and the personal enjoyment of mastering skills needed for manipulation of objects such as a parachute, balls, balloons, a net swing, a tilt board, jump ropes, and a large barrel. Activities focused on the objects or on a group outcome event to avoid cortical control of movements and to allow subcortical integration of sensory input to occur. At times activities were specifically designed to require reflex-inhibiting postures. Although treatment was carried out in a group setting, patients were encouraged to pursue a particular activity individually, if they demonstrated a desire to do so, while the group was involved in something else. For instance, two patients particularly enjoyed jumping rope and often did so independently after the jump rope was made available to them. Several patients sought out the swing for short periods of spinning at various times throughout the treatment periods. This allowed for flexibility within the group and for individual adaptive responses.

Results

Group scores for the NOSIE-30, grip strength, gait, and The Object Manipulation Speed Test were subjected to statistical analysis in a one-tailed test using the Mann-Whitney U-test. Comparisons of change between the two groups showed significant improvement at the .05 level for the experimental group on the post-test of the NOSIE-30. Comparisons of change between the experimental and control groups indicated no significance on any of the other variables measured.

NOSIE-30 scores for each group were further analyzed by the Mann-Whitney to determine what changes, if any, had occurred within each group. Significant results \( (p \leq .05) \) were obtained for the experimental group on the composite score. Analysis of the individual subcategories also showed significant improvement \( (p \leq .05) \) in the reduction of manifest psychosis within this group. Within the control group, the only change was an improvement in personal neatness \( (p \leq .05) \).

Further use of the Mann-Whitney for within-group analysis of the remaining variables indicated no significant change for either group when regarding total composite scores. However, within the control group, scores for The Object Manipulation Speed Test showed a significant increase \( (p \leq .05) \) in the right hand only.

Individual group analysis of gait indicated a trend toward improvement in the experimental group, but failed to reach significance. There was no improvement in the control group. Within the experimental group, grip strength was less than normal initially and showed 2 to 3 pounds improvement in each hand on the post-test. Grip strength in the control group was below normal levels initially and showed an average increase of 5 pounds in the right hand and a decrease of 2 pounds in the left hand.

The videotapes were reviewed by members of the hospital clinical research unit and other hospital staff, including psychologists, psychiatrists, nurses, ward personnel, and recreation technicians. Although improvements were not numerically rated, there was subjective agreement among all viewers regarding improvement in posture and increased range and fluidity of movements in the experimental group. In addition, staff members noted the appearance of more normal affect, less flexion in the arms, decreased psychomotor retardation, and better use of the hands in fine motor activities for this group.

Improvements in posture and general body movements were not reported in the control group. Viewers did comment, however, that patients in both groups appeared to follow verbal directions better in the post-test tape and to require less imitation and physical manipulation to achieve required postures and movements.

Discussion

Although the results do not demonstrate statistically significant differences on all the variables measured in the experimental group, trends noted in the data appear to indicate that improvement did occur in each of the areas evaluated. Had the study continued for 6 weeks more as planned, more of the post-test scores might have reached significance. For instance, two patients from the experimental group obtained a perfect score of 11 on the post-test in the gait analysis. There was a total group increase of 6 points. In the control group, this trend was not noted. The total group score increased by only 1 point.

A closer examination of the individual scores on The Object Manipulation Speed Test revealed dif-
different trends in hand use between the two groups. Group scores for the control group indicated a significant improvement in the right hand only. Individual raw scores show that the right hand improved by an average of 5.7 points. However, in five of these subjects, the left hand scores decreased an average of 5 points.

Within the experimental group, mean scores for both hands indicated slight improvement. Four subjects improved an average of 5 points in the right hand and three subjects improved an average of 9 points in the left hand.

These scores present a rather puzzling picture. A slight improvement of both hands appears in the experimental group, with three subjects showing marked improvement in left hand use. Of these three, only one subject was left handed. Although the right hand scores for the control group improved significantly, five of these subjects demonstrated much poorer left hand scores.

One explanation for the difference between the two groups may be based upon the type of activities each group pursued in the 6-week treatment period. The experimental group primarily pursued gross motor activities in which both sides of the body were used. The scores for this group may indicate that more bilateral integration began to occur in these individuals.

The control group, on the other hand, pursued grooming, arts, crafts, and table games. Since all seven subjects were right handed, it is assumed they used their right hands for the majority of these activities. It is possible that the control group's right hand improvement is indicative of unilaterally improved motor skills based on practice, to the extent that left-handed motor ability actually declined. The total group scores for the experimental group were much lower as a whole than scores for the control group, indicating that greater psychomotor retardation existed within the experimental group initially.

Though neither group showed a significant change in grip strength scores, the trends between the two groups appear to support the trends noted in 'The Object Manipulation Speed Test scores. The control group was stronger initially in both hands. The right hand showed an increase in strength (mean = +5 lb) on the post-test, whereas the left hand decreased in strength (mean = -2 lb). In the experimental group, both hands showed 2- to 3-pound increases. All subjects showed initial scores that are regarded as much lower than the average adult would be expected to achieve.

Behavioral Changes. On the NOSIE-30 the experimental group did demonstrate statistically signifi-

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<tr>
<th>Table 1</th>
<th>Comparison of Pre-Post and Between-Group Differences</th>
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<tr>
<td></td>
<td>Experimental Group</td>
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<tr>
<td></td>
<td>Pre-Test Post-Test</td>
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<tr>
<td>Social Competence</td>
<td>95 85</td>
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<tr>
<td>Social Interest</td>
<td>64 38</td>
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<tr>
<td>Neatness</td>
<td>70 72</td>
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<tr>
<td>Irritability</td>
<td>56 39</td>
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<tr>
<td>Psychosis</td>
<td>31 16*</td>
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<tr>
<td>Depression</td>
<td>24 9</td>
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<tr>
<td>Remaining Factors</td>
<td>31 39</td>
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<tr>
<td>TOTAL SCORE</td>
<td>371 298</td>
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<td>(x = 53) (x = 43)*</td>
<td>(x = 54) (x = 51)</td>
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*Significant at .05 level.
Table 2
Comparison of Pre-Post and Between-Group Differences

<table>
<thead>
<tr>
<th></th>
<th>Gait Analysis</th>
<th>Object Manipulation Speed Test</th>
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<tr>
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<td>Experimental Group</td>
<td>Control Group</td>
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<td></td>
<td>Pre-Test</td>
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<tr>
<td>Median</td>
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<td></td>
<td>47</td>
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<td>273</td>
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*Significant at .05 level.

significant improvement in the composite score. In exploring the more specific behavioral changes that occurred in this group, significant improvement occurred in the subcategory of psychosis.

Items evaluated in this subcategory related to the presence of both visual and auditory hallucinations, inappropriate affect, and to other observable abnormal behaviors such as talking to oneself. The improved score in this category indicates a marked reduction in these clinical signs of psychosis. In addition, the areas of social interest, irritability, and depression showed strong trends toward improvement, but failed to reach significance (Table 1). The improvements in these areas indicate that the patients demonstrated decreased behavioral out-

bursts, mood swings, and depression, and showed an increased interest in and awareness of the people and events around them. Improvement in social competence was also noted in the raw scores (Table 1). Though statistical analysis is useful for normative applications when using the NOSIE-30, the authors of this tool state that "as criterion measures raw scores will probably provide the most sensitive indices of change." (26, p 182) Considering this use of the tool, the raw scores noted in the experimental group indicate marked changes not apparent in the control group.

In contrast, the control group showed significant improvement only in the area of neatness. However, grooming was a part of this group's occupational therapy activities each day. The men were given assistance in shaving and hair care. The women were assisted in hair care and make-up application. Shirts were re-buttoned correctly and shoelaces were tied with the assistance of the staff. As a result, subjects returned to their wards each day neater than they had left them. The significant improvement in this group's neatness does not represent an advanced level of functional independence on the part of the individuals. At no time did they arrive ready to begin the group's activities having already completed any grooming activities independently.

The improvements noted on clinical observations for the experimental group support the scores from the NOSIE-30. Socialization skills in this group progressed from a level of no interaction to a level of appropriate social interchange. Interest and initiative also emerged.

A review of the information gathered from the daily clinical observation notes provided addi-
tional insight into many of the other individual changes that occurred. Within the experimental group, the majority of subjects were nonverbal in the beginning. Slowly the group began to verbalize. Initially, this consisted of one-word responses to questions by staff members. Gradually, subjects began to initiate short sentences, often requesting a certain activity or offering a brief explanation when declining to do a group activity, for example, “I want to swing now,” or “I need to rest first,” or “Let him be ‘it’ instead.” This last statement eventually became indicative of the group’s shared sense of humor, which was absent at the start.

One woman in the group was very verbal initially and often hostile and aggressive toward staff and patients. Her behavior improved from day to day. After the first 2 weeks of treatment, not one behavioral outburst was noted. Ward personnel commented to occupational therapy staff members that this individual was more cooperative and appeared more relaxed than previously. Her references to hallucinations ceased altogether. Hospital staff members who viewed her performance on the videotape consistently commented on a more normal affect with noticeable relaxation of facial musculature on the post-test. The patient herself commented that she felt she was “getting stronger” as a result of the activities she pursued during each group session.

In the experimental group, staff members noted improved eye contact, increased ability to initiate an activity, including locating and obtaining the necessary equipment; improved affect, including smiles and laughter; an ability to indicate personal needs; decreased perseverations; somewhat improved physical appearance (shoes tied, shirts tucked in, buttons buttoned); and a sense of pleasure when accomplishing a new task for the first time, such as jumping rope successfully or catching a ball. It was also noted that patients were more responsive and appeared to perform better on the days when more staff were present in the group. More individual attention was possible and group members were able to pursue individual activities with staff interacting as needed. At the same time, the other staff members might be conducting a group activity or working independently with two or three individuals only. This allowed for greater flexibility within the 1-hour treatment period, which always began and ended with total group activities. In general, it appeared that these regressed chronic patients began to display more developmentally appropriate behaviors, particularly in socialization.

In the control group, most of the patients were verbal, but some had unintelligible speech patterns that did not improve. Most of the patients appeared to enjoy the grooming and craft activities, but no one initiated any activity. They remained passive and waited to be instructed at each step of a task. Some were not able to function well enough to participate in all of the activities independently. It was difficult for staff to differentiate this behavior as a lack of interest or an inability to follow verbal instruction. Certain patients perseverated more noticeably than others. This did not decrease. Behavioral outbursts, in general, remained unchanged. Socialization skills failed to emerge.

Implications for Further Research
This study reveals several issues to be considered before attempting further research in this area. To avoid biasing the results, patients were randomly assigned to each group. However, in a disease as complex as schizophrenia, it is impossible to have two identical groups of subjects. Individuals experience the illness in a unique manner and the resulting types of dysfunction vary. Hence, individual differences existed in this study and were reflected in such variables as age, years of illness, levels of functioning, and handedness. After the 14 subjects were chosen and initially evaluated, a stronger design would have resulted had the two groups been carefully matched. This would have prevented the experimental group from containing all the left-handed subjects and being composed of more dysfunctional subjects in general. Scores of all the variables measured revealed that this group functioned on a much lower level than the control group did. This lessened the chances for accurate comparison between the two groups and may have inadvertently biased the study.

Another consideration regarding the design was the decision to have two groups of subjects with the same diagnosis receive different types of therapeutic intervention. This was done for the purpose of comparing the sensory integrative approach with a separate occupational therapy treatment approach, and thus, there was no real “control” group in the classical sense. However, dividing the subjects into two groups resulted in such a small total for each group that the chances for demonstrating statistical significance on the variables measured were reduced. Considering the initial attention given to selecting patients who carefully matched King’s description of process schizophrenia, a stronger design in this
instance might have resulted had all 14 subjects received sensory integrative activities, with each subject serving as his or her own control. Fourteen subjects would have increased the possibility of demonstrating statistically significant changes on each of the variables measured. An alternative to this design would have been to compare these 14 subjects to the group of process schizophrenic patients who remained on the ward and received no treatment.

More research is needed to validate King's theory. This study represents an initial attempt to do this. Perhaps the strongest research design for a diagnosis as complex as process schizophrenia is that of the single case study. A series of single case studies could be effective in documenting change within individuals in this population and would be much easier for therapists to manage logistically.

Summary and Implications for Clinical Practice
This study was conducted to compare the effects of 6 weeks of treatment in a sensory integrative program with the effects of a sedentary occupational therapy activities program in a chronic, nonparanoid process schizophrenic population. The results indicated that the group receiving sensory integrative activities showed varying degrees of improvement in each of the areas measured, with the most significant gains reported in general behavior, as measured by the NOSIE-30, with specific improvement in the subcategory of psychosis. The variables of gait, hand strength, and psychomotor retardation showed general trends of improvement, though none reached significance.

The control group demonstrated specific improvement in right hand use and in grooming. Daily clinical observation notes indicated that the sensory integrative group improved in the areas of interest, initiative, and socialization skills. Though the control group appeared to enjoy grooming and table activities, no improvement was noted in initiative and socialization.

These findings suggest that a sensory integrative treatment approach in the chronic, nonparanoid process schizophrenic population can improve these patients' functional abilities and prepare them to participate more fully in other areas of treatment.

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REFERENCES
7. Angyal A, Blackman N: Vestibular reactivity in schizophrenia. Arch Neurol Psychiatry 44: 611-620, 1940
10. Myers S, Caldwell D, Purcell G: Vestibular dysfunction in schizophrenia. Biol Psychiatry 7: No. 3, 1973