NEUROPSYCHOLOGICAL REMEDIATION OF HYPERACTIVE CHILDREN

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ABSTRACT

Hyperkinesis is associated with deficits of attention (poor allocation of attention resources, susceptibility to interference and perseveration), vigilance and perceptual sensitivity. Three boys aged 7-8 years with simple hyperkinesis were given cognitive tasks to improve the above functions in daily one hour sessions for a month. The children improved significantly in the above functions and behaviour. Three other children aged 5-8 years with simple hyperkinesis who were on medication improved only slightly in their behaviour during this period. Behavioural intervention and parental counselling were additional inputs to the children in both groups. Neuropsychological remediation combined with parental counselling and behavioural intervention shows promise in treating hyperactive children.

Key words: Hyperactivity, attention deficit disorder, neuropsychological deficits, cognitive tests

Hyperactive children have deficits in prefrontal neuropsychological functions. Impairments are present in focused attention (Ceci & Trishman, 1984), vigilance (Prior & Sanson, 1988), strategies for allocating attention resources (Sergeant & Scholten, 1985), concept formation, visual scanning, sequential memory and perseveration (Gorenstein et al., 1989). Pharmacotherapy with stimulants and behavioural interventions are treatments of choice (Arnold & Jenson, 1995). The present study examined the effectiveness of neuropsychological remediation in children with hyperkinesis.

MATERIAL AND METHOD

Six boys in the ages of 5-8 years with hyperkinetic syndrome as per ICD-9 (314.0, 314.1 & 312.2) who attended the child guidance clinic of the department of psychiatry, NIMHANS were studied. The patients were right handed with no history of mental retardation, psychiatric or neurological disorders or situational hyperactivity. The nature of neuropsychological deficits were examined as follows - In the test of vigilance and perceptual sensitivity, the child identified a bell against a background noise for 10 minutes, with the correct identifications indexing perceptual sensitivity and the difference between the first and last 5 minutes indexing vigilance; colouring of designs at four levels of difficulty with the speed and accuracy as scores formed the task for allocation of attention resources; the sequential memory test and the sequential matching memory tests (Gorenstein et al., 1989) measured susceptibility to interference and perseveration respectively; colour cancellation test measured visual scanning, object sorting test measured concept formation and the digit span test measured immediate memory. In each test the patient's
performance was compared with that of ten comparable normal children for documenting a deficit. The Connor's rating scale (parent version) (Connor, 1969) and time off task using head, hand and face/eye movements (Sergent & Scholten, 1985) rated behaviour.

In each patient remediation was initiated in the area of severe deficit. A colouring task using geometric shapes of increasing complexity improved allocation of attention resources, with sweets as rewards for improving speed and accuracy. Identifying a target word against a background noise of increasing meaningfulness, i.e. white noise, traffic noise and music improved perceptual sensitivity and vigilance. Target animal pictures were also identified from pictures of different animals. Connecting randomly arranged alphabets, number or similar geometric shapes improved focused attention. Sorting cards with similar symbols reduced perseveration. The children were daily seen for an hour for four weeks. The method of saturation cueing was followed, wherein the difficulty level increased only after the patient saturated on the previous level (Diller & Gordon, 1981).

RESULTS

Cases in the remediation group

Case 1 : A 7 year old boy, elder of two siblings from middle socio economic status presented with symptoms of over activity, poor concentration, poor writing ability, stubbornness, setting fire to match sticks, poor scholastic performance, disruptive classroom behaviour since two and a half years. History of 5 attacks of febrile convulsions at 14 months, and a 3-4 month delay in developmental milestones of walking and speech were present. A five year regimen of anti convulsants had been withdrawn a year ago. Deficits were present on all tests. Remediation was given to improve allocation of attention resource; focused attention and reducing perseveration. Conduct problems were addressed with behavioural techniques of time out and differential reinforcement. Parents were counselled regarding implementing behavioral management. After retraining, the child improved in the targeted areas. Conduct problems and time off task reduced. Though all the functions could be tested, the performance did not reach normalcy (table). Parents reported 50% improvement.

Case 2 : A 8 year old boy, the only child from middle socio economic background presented with a 3 year history of poor concentration, impulsivity, lying and crying if demands were not met. Speech was delayed. School performance was average. Sequential memory and visual scanning were poor. Vigilance and perceptual sensitivity were normal. Perseveration was absent. Behavioural problems were present (table). Focused attention and attention resource allocation were trained in first two weeks and the latter alone in the last three weeks. Behavioural intervention was given with differential reinforcement. After the retraining, test performance, behaviour and concentration were normal. Parents and teacher reported remarkable improvement.

Case 3 : A 7 year old boy, elder of two siblings from middle socio economic background presented with hyperactivity since infancy with poor concentration, restlessness and difficulty in writing since 4 years. Developmental milestones and intellectual functioning were normal. Parents had marital discord. Performance on most tests were poor prior to the retraining. Focused attention and allocation of attention resources were retrained in first two weeks. Vigilance and perceptual sensitivity were added to the regime in the next two weeks. Perseveration could not be addressed as the parents were unwilling to bring him for treatment. After the retraining, focused attention and attention resource allocation improved slightly but vigilance and perceptual sensitivity did not. Concentration and obedience improved with the therapist but not with parents.

Parents of the above three children were counselled as to the nature of the problem.

Cases in the control group

Two children whose parents could not
TREATING HYPERACTIVITY WITH COGNITIVE RETRAINING

**TABLE**

| Tests                              | Cases of treatment group | Cases of control group |
|------------------------------------|--------------------------|------------------------|
| Sequential memory                  |                          |                        |
| Pre                                | 1                        | 1                      |
| Post                               | 2                        | 2                      |
| Post                               | 3                        | 3                      |
| Sequential matching memory         |                          |                        |
| Pre                                | 4                        | NT                     |
| Post                               | 4                        | NT                     |
| Perceptual sensitivity             |                          |                        |
| Pre                                | 3                        | 1                      |
| Post                               | 4                        | NT                     |
| Vigilance                          |                          |                        |
| Pre                                | NT                       | NT                     |
| Post                               | NT                       | NT                     |
| Speed of coloring                  |                          |                        |
| Pre                                | 20                       | 20                     |
| Post                               | 220*                     | 200*                   |
| Accuracy of Coloring               |                          |                        |
| Pre                                | 1*                       | 1                      |
| Post                               | 2*                       | 1                      |
| Single color cancellation           |                          |                        |
| Pre                                | 20                       | NT                     |
| Post                               | 50*                      | NT                     |
| Double colour cancellation          |                          |                        |
| Pre                                | 5                        | 50                     |
| Post                               | 70*                      | NT                     |
| Object sorting by color            |                          |                        |
| Pre                                | 10                       | NT                     |
| Post                               | 35*                      | NT                     |
| Objects sorting by form            |                          |                        |
| Pre                                | 10                       | NT                     |
| Post                               | 35*                      | NT                     |
| Digit span forward                 |                          |                        |
| Pre                                | 4                        | 2                      |
| Post                               | 8*                       | 2                      |
| Digit span back ward               |                          |                        |
| Pre                                | 0                        | 0                      |
| Post                               | 5*                       | 3                      |
| Connors rating scale               |                          |                        |
| Pre                                | 26                       | 26                     |
| Post                               | 21*                      | 21                     |
| Time off task                      |                          |                        |
| Pre                                | 20                       | 20                     |
| Post                               | 4                        | 4                      |

* - no deficits

bring them daily for cognitive retraining and one inpatient formed the control group. Cases 1 & 2 were medicated with haloperidol 7.5 mg/day and trihexyphenidyl 2 mg/day, while case 3 was unmedicated. These cases also received parental counselling as to the nature of the problems and behavioural intervention with differential reinforcement and time out.

Case 1: An 8 year old boy, last of 5 siblings from a lower socio economic back-
ground presented with history of restlessness, destructive behaviour, beating younger children and urinary incontinence, since 3 years. Birth asphyxia and delay in developmental milestones and poor intellectual functioning were present.

Case 2: A 5 year old boy, the last of 6 siblings from a middle socio economic background presented with symptoms of restlessness, poor concentration, quarrelsome and stubborn behaviour, since 2 years. Mild delay in developmental milestones and normal intellectual functioning were present. He was admitted in the children's ward for 4 weeks.

Case 3: A 5 year old boy, the only child, from a middle socioeconomic background presented with symptoms of restlessness, overactivity, temper tantrums, demanding, negativistic behaviour, since 4 years. Delayed speech and normal intellect were present.

In the initial assessment, these three children had significant restlessness with deficits in all the tests, behaviour problems and time off task (table). The final assessment after 4 weeks found that case 1 had improved in hyperkinesis as reported by parents; case 2 had substantially reduced behaviour problems with a parental report of decreased activity level; case 3 had slight reduction in time off task with a parental report of improved concentration. The cognitive functions did not improve in the control group.

DISCUSSION

The treatment group improved in the functions retrained. Other cognitive functions improved slightly but not to the level of normalcy. Behaviour problems and time off task reduced significantly. The control group did not improve in their cognitive functions, but behaviour problems and time off task reduced slightly. As the patients in the two groups were similar in their age range, nature of symptoms, parental motivation (voluntarily seeking help) and received similar adjunct therapy (parental counselling and behavioural intervention), the significant improvement in behaviour seen in the treatment group may be attributed to the gains in cognitive functioning arising from neuropsychological remediation. Milder cognitive deficits in the treatment group might have contributed to the efficacy of neuropsychological remediation.

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