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Minimal brain dysfunction in children

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MINIMAL BRAIN DYSFUNCTION IN CHILDREN

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MINIMAL BRAIN DYSFUNCTION IN CHILDREN

Minimal brain dysfunction in an entity which has been described with increasing frequency in recent years. Historically it has been identified in children of school age who have been referred for evaluation because they have displayed scholastic under achievement. It has been determined that most of these children are of normal intelligence[25,58,81] which separates them from mentally retarded children with similar behavior characteristics. Difficulty in adjustment to school is attributed to a number of behavioral irregularities, most common of which are restlessness, impulsivity, and explosive behavior.[35]

Because the child with minimal brain dysfunction is usually presented to the physician for diagnosis, and treatment, it behooves each physician whose practice encompasses children to be aware of the early signs and symptoms of minimal brain dysfunction. The problem of the syndrome then becomes multidisciplinary with involvement of many auxillary personnel such as the child psychiatrist, speech therapist, social worker, neurologist and teacher.

Early treatment should be aimed at interrupting repetitive and unrewarding parent child patterns, enhancing the learning ability of the child and ameliorating his hyperactivity and emotional liability.

CAPSULE OF HISTORY

The problem of semantic confusion concerning minimal brain dysfunction[11,12,14,15] is not easily solved because of the variety of ways in which the syndrome may present itself. Less common, but adding to the confusion, are such labels as organic brain damage,[13] minimal cerebral damage,[44] hyperkinetic impulse disorder,[47] Strauss syndrome,[71,72,73] minimal brain damage,[58] and organic child.[27] Minimal brain dysfunction is the term used in this paper because it is general in nature and does not imply structural damage. Many of the other terms may be equally efficaceous in the minds of other authors and it is probably from this reasoning that the confusion of semantics got its very roots. Although there is a variety of terminology the following review outlines the historical concepts which describe children who display the behavioral and adaptational dimensions of minimal brain dysfunction.

In 1929, Schroeder[65] described a syndrome much like that

what we call minimal brain dysfunction to-day in children born to mothers who had had a particularly difficult labor and delivery. He described these children as being hyperactive and distractable with personality traits and behavior problems differing from normal children. The children did not necessarily suffer from palsies but frequently had the above described behavioral manifestations alone.

In the same year, Kasanin,[42] also described personality changes and traits similar to those found in the syndrome of minimal brain dysfunction today, in children who had suffered from brain damage: Namely stealing, temper tantrums, stubbornness, mood lability, truancy, and scholastic underachievement. So Schroeder and Kasanin may truly be considered early workers in this field.

Kahn and Cohen,[41] in 1934 attached the term"organic driveness" to a group of patients which they believed suffered from a "surplus of inner impulses," due to defective brain stem organization. Their description of behavior disorders, personality traits, and learning difficulties is in close agreement with modern day description of minimal brain dsyfunction.

Perhaps most notable of all the early writers of minimal

brain dysfunction is Strauss,[71,72,73]. In his work in the 1940's, Strauss divided mentally defective individuals into two catagories: Endogenous for familial and exogenous. Those mentally deficient patients who were relatively unresponsive to external stimuli were considered of exogenous cause. Endogenous mentally deficient individuals were, on the other hand, fairly responsive to external stimuli. He believed that exogenously deficient individuals suffered from sensory motor malfunction and fell well behind normal individuals where coordination of motor and sensory function were required. He successfully used a marble board test to separate these from the endogenous group who could perform the task with the marble board almost as well as normal individuals. The exogenously deficient individuals were scholastic under achievers and also suffered from behavioral deviations and difficulty in adjustment. Strauss treated his brain injured or exogenous children in part with special education and found it to be of value in the majority of cases.

In 1951, Dall[26] wrote an article concerning the behavioral manifestations of early brain damage and labeled the entity "neurophrenia". Other workers who wrote articles discussing some aspects of minimal brain dysfunction during the 1950's include Laufer, Denhoff, and Salamen[47,49]

who described the hyperkinetic impulse disorder and its role in the behavior problems of children. Also the electroencephalogram was used with increasing frequency in the 1950's. The abnormalities which may occur on the electroencephalogram of children with minimal brain dysfunction were found not to be typical enough to warrant a diagnosis from those alone, but Piser and Zeigler[59] found that 14 and 6 per second spikes were found quite frequently. Kuobloik and Pasamanick[44] discussed at length the symptoms of minimal brain dysfunction in infancy.

A growing need to work out the problems of identification, terminology, services and research in minimal brain dysfunction resulted in the formation in 1963 of a committee in Washington, D.C., to develop a symposium on the child with minimal brain dysfunction. Phase I of this project resulted in NINDB, Monograph Number 3 which is a comprehensive and up-to-date review of terminology and identification of these children. In conclusion, still more knowledge concerning the clinical picture, clinical course, effect of emotional development, and cause of minimal brain dysfunction is desperately needed. This knowledge would appear best to come from communication among those physicians who deal with afflicted children with minimal brain dysfunction.

SIGNS AND SYMPTOMS OF MINIMAL BRAIN DYSFUNCTION

There are no pathognomonic symptoms and/or signs of minimal brain dysfunction, although there are certain one which are highly suggestive of the disorder. Hanish, et al,[38] divides the pathological manifestations of brain dysfunction into two types: 1) symptoms and/or signs from the actual brain dysfunction and 2) symptoms and/or signs which are not directly associated with tissue loss but are symptoms of indirect or superimposed pathological disturbance. It must be realized that there exists a great deal of overlapping between the two and each affects the other. The following discussion describes the most common signs and/or symptoms found in school age children which make it easier to diagnose minimal brain dysfunction. Of course, it should be noted that not all of these will occur in any one child.

1) Motor Disturbances: Hyperkinesia or hyperactivity is the most commonly found symptom of minimal brain dysfunction. It is usually manifest by motor symptoms including fingering, touching, inability to sit still, and always being on the move.[15,35,55,81] Mild choreathetosis,[36,58] and hand tremor[58] are less frequently found. A developmental lag or disturbance in motor skills may also be present is the child.

with minimal brain dysfunction,[4,5,55] as expressed in such things as rolling, sitting, crawling, walking and running at an age later than normally expected.

2) Academic and Adjustment Impairment: Inconsistant scholastic performance is one of the most characteristic symptoms of minimal brain dysfunction in children and is a very frequent presenting complaint. Language disorders, including reading, [15,36,55] writing,[17,55] and spelling, [19] are frequently found as is the ability to comprehend mathematical concepts. Overall, the verbal performance is usually better than the written performance. A poor ability to organize work and a slowness in finishing work are also outstanding in the afflicted children.

3) Disorders of Perception and Concept-formation: Impairment of perception or concept formation is also characteristic of the child with the syndrome.[13,16] some examples of these disorders include impairment in discrimination of: size;[79] right and left; down and up; part and whole;[79] and figure and background.[55] In addition to these, the child often has poor spatial and time orientation. He may also have a distorted concept of body image.[79] Strephosymbolia or perceptual

reversals in reading an in writing is another frequent symptom of minimal brain dysfunction.[20]

4) Disorders of Motion: The child with minimal brain dysfunction usually suffers from emotional lability which is manifest by such things as irritability, temper tantrums, frustration, and rage.[12,24,36] He is said to have a low threshold for embarrassment by environmental stimuli which partially results in his emotional lability.[15] His emotions are explosive and impulsive.[35] He is also emotionally immature displaying characteristics which are typical of younger children.

5) Disorders of Thought Process: An impaired ability for abstract thinking is almost invariably present in children with minimal brain dysfunction,[13,37] and therefore they tend toward concrete thought process.[37] These children also have difficulty learning new things because of impaired recent or short term memory.[37] They may also display long term memory deficit.[37] Austistic thinking may develop in a child with minimal brain dysfunction[15,25] and often will display perseverative, [53] regressive,[53] and confused[55] thought processes.

6) Disorders of Attention and Concentration: The child with minimal brain dysfunction has a poor ability to con-

centrate,[4] is easily distracted, [4,13] and his attention span is noted to be decreased for his age.[25,36] Perseveration is also commonly present in such children.[37,53]

7) Disorders of Social Behavior: Immature and inappropriate social behavior is a common finding in children with minimal brain dysfunction.[4] However, at times they also show antisocial behavior and frequently display poor social judgement.

8) Disturbances in Relationships: The afflicted child has poor peer relationships in general and adjusts best when playmates are limited to one or two. He is easily excited, bold, and aggressive when playing and has an excessive need to finger, touch or hold on to others.[15,35] He may also display an inappropriate and unselective affection,[15] and autistic behavior sometimes occurs.

9) Personality Disorders: Wide fluctuations in mood from day to day and even hour to hour are characteristic of the child with minimal brain dysfunction. He is also easily led by his peers or playmates. He has a decreased ability to adapt or adjust to alterations in his environment.[36] He is a very sensitive individual and is easily incited to temper tantrums and rage.[12,24,36]

10) Sleep Disorders: Irregular patterns of sleep are

commonly found in children with minimal brain dysfunction as compared to healthy children of comparable age. These disturbances may be an increase or decrease from the normal amount.[24] Head banging and/or body rocking are also found prior to sleep in some of these children.

11) Disorders of Speech and Communication: Impairment in speech and communication is frequently found in children with minimal brain dysfunction. They may suffer from a mild hearing loss or may have mild speech irregularities. Slow language development is also found, [4, 57] as is impaired discrimination of auditory stimuli and various catagories of aphasia may be present.

12) Physical Developmental Disorders: Children who suffer from minimal brain dysfunction are very apt to have lags in their developmental land marks or milestones,[4,58] They very commonly show a general maturation lag[4,58] and physical development may fall behind chronological age although it may also be normal or advanced.

13) Specific Neurologic Signs: Ordinarily, the child with minimal brain dysfunction has few if any gross neurologic findings. However, frequently "soft" neurological signs are found. These are listed in Table Number I.

EQUIVOCAL NEUROLOGICAL SIGNS SOMETIMES ASSOCIATED WITH MINIMAL BRAIN DYSFUNCTION

MOTOR	impaired fine and gross coordination[37,13]
	strabisms[13,58]
	gait disturbances[55]
	spasticity[55]
	clumsiness[35,36,58]
	impaired succession movements[58]
	persistence of associated movements
	mild choreoathetosis[35,58]
	hand tremor[58]
	hyper or hypokinesia
SENSORY	decrease in tactile discrimination
	poor graphesthesia[55]
REFLEXES	immature postural reflexes[55]
	extensor planter reflexes [37,58]
	hyper reflexia [34,]
MISCELLANEOUS	impaired identity of body parts[37]
	cross laterality[16,37,39]

Pre-school children may lack many of the very characteristic symptoms as those mentioned above as these may not have evolved yet. Also, in the pre-school child it is particularly difficult to differentiate abnormal behavior from extremes of normal. The special problems of the pre-school age child with minimal brain dysfunction are discussed below.

PRE-SCHOOL CHILDREN WITH MINIMAL BRAIN DISFUNCTION

The special problem of pre-school children who suffer from minimal brain dysfunction is perhaps a difficult one if not in some cases insurmountable. The importance of early diagnosis, which has been discussed earlier, cannot be denied, yet, these children often remain unrecognized because many of the signs and symptoms which were previously mentioned cannot be discerned in these small people.

There are some symptoms peculiar to this age group which, while they are certainly not diagnostic of minimal brain dysfunction, call to the physician's attention the very prominent possibility of this syndrome. Careful questioning of the parents on routine well-baby check-ups may at least reveal reason to be suspicious of abnormality and enable the physician to give the child more comprehensive care.

The following is a list of the more common symptoms and/or signs of minimal brain dysfunction; refusal to nurse, poor sucking ability, vomiting, tremors, atheotosis, stiffening and/or arching of the back, decreased startle threshold, increase in sleep, irritability[24] and an abnormal cry.[24,31] Concerning the latter, Fischelli[31] compared the phonetic contents of the cries of normal infants and those with brain

dysfunction, and found that a normal infant would make more total sounds and fewer nasal sounds than an infant with brain dysfunction.

DIAGNOSIS AND EVALUATION OF MINIMAL BRAIN DYSFUNCTION

The increasing frequency with which the diagnosis of minimal brain dysfunction is being made could be partially due to one or more of these factors:

A) An apparent increase in the number of children who are afflicted with this dysfunction of the neurologic system,

B) the growing necessity for more precise classification of the learning and behavioral disorders of children as these classifications lend themselves to increasing the usefullness of statistical data to research workers and program planners,

C) the growing dissatisfaction with psychogenic and/or inter-personal explanations as the only causes of abberant behavior,

D) an increased refinement in diagnostic techniques and skills in recent years.

The diagnosis and evaluation of minimal brain dysfunction is based upon a medical evaluation including history, physical examination, laboratory tests,[35,37] and a behavioral assessment. Some authors feel that the history is the most important diagnostic tool,[36,53] although the other methods certainly lend indisensible support and aid in the diagnosis.

Medical Evaluation:

History: In addition to attention to the symptoms and/or signs of minimal brain dysfunction mentioned on previous pages, a good history from the parents also includes a pre-natal, peri-natal and post-natal history of the afflicated child. Table II lists some of the diseases associated with or causing minimal brain dysfunction.

TABLE II

DISEASES POSSIBLY ASSOCIATED WITH OR CAUSING MINIMAL BRAIN DYSFUNCTION

PRENATAL:[12]

Maternal rubella
other viral exanthems
pre eclampsia
blood incompatability
Maternal diabetes
Thyroid disorder
Radiation
Medication
Multiple birth
Polyhydramnios
Placental abnormality

PERINATAL:[12,45,58]

Prematurity
Postmaturity
Jaundice
Infection
Convulsions

POSTNATAL:[12]

Toxic condition
Infection
Traumatic
Metabolic disorders
Convulstions

Another important aspect of history is the developmental history including personal-social, language, motor, and adaptive spheres. A third phase of the history should include the family's social history with detailed information regarding family culture and constellation.

Physical examination: The general physical examination and gross neurological examination should be the next steps in the work-up of a child with minimal brain dysfunction to rule out the presence of gross systemic disease.[58] Ordinarily there will not be any abnormality discovered with the examination in gross. Next the physician should proceed with the detection of the "soft" neurological signs which are characteristic of minimal brain dysfunction. (See Table I.) In smaller children and infants who lack the "Soft" or equivocal neurological sign, certain reflexes can be tested which may give an indication of minimal brain dysfunction. These reflexes are listed in Table Number III. Persistence of these reflexes beyond the expected limits of time, as depicted in the table, may indicate the presence of dysfunction.

TABLE III

OCCURRENCE OF PHYSIOLOGICAL REFLEXES

	(age in Months)										
	1	2	3	4	6	9	12	15	18	24	36
REFLEX											
LANDAU	0	0	0	0	0	0	x	x	x	x	0
Parachute	0	0	0	0	x	x	x	x	x	x	x
Neck Righting	0	0	0	x	x	x	x	x	x	x	x
Asymmetric Neck Tonic Reflex	x	x	x	x	0	0	0	0	0	0	0
Moro	x	x	x	x	0	0	0	0	0	0	0
Palmer	x	x	x	x	0	0	0	0	0	0	0
Reciprocal Kicking	x	x	x	x	x	x	0	0	0	0	0
Rooting and Sucking	x	x	x	x	x	x	0	0	0	0	0

Laboratory Test: In addition to the history and physical examination the laboratory examination in an important part of the armentarium. Routine tests which should be ordered in each case include: complete blood count, urinalysis, blood sugar, electrolytes, calcium, protein bound iodine, and serology.[58] In selected cases where they are indicated by clinical findings, the following may also be useful: electroencephalogram, carotid arteriography, brain scan, echoencephalogram, lumbar puncture, pneumoencephalogram, skull films, biochemical and genetic assessment (chromosomal analysis).[12,58] These specialized tests will be necessary only in a minority of cases.

Behavioral Assessment:

Academic History: The child's teacher and principal should be consulted to determine the academic progress and achievement as well as behavioral activities of the student while in school.

Language Evaluation: Detailed assessment of the afflicted child's speech disabilities should all be done by a competent speech specialist.

Educational Evaluation: An educational diagnositician should do a detailed evaluation of the child's academic abilities.

Psychological Evaluation: The method of psychological evaluation is twofold--(1) The behavior of the child should,

be observed in a variety of settings by an objective; (2) specific psychological tests, which are commonly utilized in the diagnosis and evaluation of the child with minimal brain dysfunction, are discussed below.

Test of Motor Performance:

A) Frostig Development test of Visual Perception: [33,56] This test is constructed to explore five areas of visual perception which are hand coordination, finger ground perception, form constancy, position in space and spatial relationships. Many research studies have reported an impressive relationship between perceptual disabilities and neurological handicaps. Therefore, it has been postulated that a test of visual perception might be a useful tool in a battery of tests for the diagnosis of brain damage.

B) Benton's Visual Retention Test: [34,10] The Visual Retention Test has proved to be of specific value in the examination of children over the age of nine who are suspected of having cerebral injury or disease. It measures neural storage, visual spatial synthesis, and memory.

C) Bender Gestalt;[6,7] This is a test which requires visual coordination and for that reason many children with minimal brain dysfunction will do poorly. It has been shown to be difficult to interpret the results of this test when it is used for children under the age of six as is also

true of the other tests of motor performance. Although no set pattern occurs, some types of abnormalities occur quite consistently in children with minimal brain dysfunction, most of which are secondary to a failure of visual motor coordination. Some of these are: fragmentation,[36] rotation of figures, [37,53] primitive deviations in design reproduction,[36] substitution of a continuous line for discrete dots,[8,36] reversals,[2,8] and repetition.[8] By the child's inability to copy angles and curves and tendency to produce gross perceptual or motor distortions the Bender Gestalt Test estimates minor neurological impairment. [79] These deficits might be thought of as showing lags of maturation, unevenness of development, regression, and perseveration.

D) Purdue Pegboard:[60] Rapin found the Purdue Pegboard quite efficaceous in testing brain damaged children. In her group, 80% of the brain damaged children displayed abnormal results. She states that the power of discovery of the test is greatest in clumsiness, hyperactivity, and visual motor dysfunction. She also found that it was not a good test to discriminate between brain damage and mental retardation, psychosis, and severe emotional disturbances. All four groups tend to score abnormally.

E) Goodenough or Draw a Person Test:[53] This test has been used as a part of a battery of tests to diagnosis brain damage but other tests have been found superior. The

abnormal results are again present because of visual motor coordination disabilities. When a child with minimal brain dysfunction is asked to draw a person, the result will be asymmetrical with usually the non dominant side of the body larger than the other.[36] The head of the drawing will usually be disproportionally large. There will usually be a scarcity of detail, heavy and unbroken lines, few erasers, and an emotionless expression upon the caricature.

Intelligence Test:

A) Wechsler Intelligence Scale for Children:[2,36]

The WISC is basically an intelligence test for children. However, some responses have been found to occur consistently in some children with known brain damage. Children with minimal brain dysfunction have difficulty with the immediate recall of a group of numbers in the correct order. If asked to recall the numbers in reverse order the difficulty increases. The child with minimal brain dysfunction is also found sometimes to do poorly on the parts of the test requiring abstract thinking, or coding, and arithmetic. In general, their overall performance is noted to have marked irregularity and fluctuance with their verbal performance being noticeably better than their written.

Projective Test:

A) Rorschach: [36,40] This test is sometimes used as part of the battery of tests upon youngsters with minimal brain dysfunction, however, there is no generally accepted method of scoring. It is of questionable value in young children. The Rorschach may help to differentiate a child with the syndrome from a child with a psychosis or neurosis as the latter patients show abnormalities in their contact with reality. Perseveration, limitation in number responses, and lack of human movement responses occur more frequently in the former.

ETIOLOGY OF MINIMAL BRAIN DYSFUNCTION:

ORGANICITY/ENVIRONMENT

Organicity is usually used as a broad term to include genetic variations,[12,15,43] biochemical abnormalities,[15] pre-,peri-, or post-natal insults such as toxic, infectious, or traumatic injury during the years critical for the normal development and maturation of the central nervous system. Included in the concept of organicity is the theory that any condition which alters normal functioning can manifest itself in learning abnormalities and aberrent behavior. These manifestations can also be a result of environmental influences.

Of course, that the total syndrome of minimal brain dysfunction is a result of both environment and organicity is known.[58] It behooves the physician, as a coordinator of the diagnostic team, to determine with the greatest degree of accuracy possible, the amount of impairment which each is contributing to the total pathology of the child. The difficulty of this is enhanced by the fact that the organicity symptoms and/or signs are overlaid with the environmental effects of perpetual frustration and disapproval.[58]

TREATMENT OF MINIMAL BRAIN DYSFUNCTION

A MULTI-SPECIALITY APPROACH

Treatment of minimal brain dysfunction should be initially directed at the correction of any physical, speech, hearing, or visual defects which may be reparable by the appropriate specialist, i.e. speech therapist, Ear, Nose, and Throat specialist, opthamalogist, etc. While the repair of these defects are being accomplished, other indicated phases of treatment may be started as noted in the following discussion.

1) Educational Programing: According to some authors,[24] children with brain dysfunction should be placed in special education classes; however, this is certainly not always practical. Roger [61] believes that children with behavoral disturbances and learning disorders should remain in the regular classroom but receive special consideration in

meeting curriculm requirements, and teachers of classes in which these children are placed should have special education orientation. Whether such children are in a special class or whether they are in a regular classroom situation, they will still need remedial help in the areas in which they are subnormal.[28] If these children are approached with a multi-sensory (auditory, visual, and kinesthetic) method, they will often do better than if more conventional teaching methods are utilized.[28]

2) Psychotherapy:[35] The child who suffers with minimal brain dysfunction will very often require some form of psychotherapy, which would best be accomplished by the child psychiatrist. This should aim towards an improvement in self control, an education of the patient towards his own feeling in life, and a forming of object relationships.

3) Drugs: Drugs used in the treatment of minimal brain dysfunction for symptomatic relief, must be varied to suit individual needs. Table Number IV lists some of the more commonly used drugs.

TABLE IV

DRUGS USEFUL IN THE

TREATMENT OF MINMAL BRIAN DYSFUNCTION

SYMPTOM AND/OR SIGN	DRUG
hyperactivity	amphetamines[13,14,47]
	phenothiazines[1,12,24,44,61]
	methylphenidate[18,55]
depression	Tofranil[24]
	Aventyl[24]
anxiety	Librium[24]
muscle spasm	Meprobamate[24]

4) Parental Counseling:[35] Counseling of the parents should be aimed at enhancing their understanding of the child's behavior and at decreasing the negative feedback often present between the affected child and his parents.

5) Alteration of Environment:[35] The child with minimal brain dysfunction should be placed in an environment which is quite structured, with firm and consistent discipline. Alteration of the environment would best be accomplished with the combined recommendations of the child psychiatrist and the social worker.

6) Doman and Delacato Method of Patterning:[22,23] Doman and Delacato have based their method for the treatment of brain damage upon the theory that "ontogeny recapitulates phylogeny". It is their belief that if an individual fails to pass through a certain sequence of developmental stages in such things as mobility and language, a failure to achieve competence in the areas of writing, reading, speech, and walking may result. Failures in these areas may reflect poor neurological organization and perhaps brain damage. Simple active and passive exercises are used to improve sensory and motor functions and to stimulate the nervous system in brain damaged individuals. These exercises are reproductions of normal activities which would have occured had the brain not been injured. Stimulation of particular area of the brain result in improved functioning and it is thought that other parts of the brain, likewise, improve.

However, Freeman[32] states that Doman and Delacato have claimed success in techniques not adequately evaluated, and Robbins, [63] in a recent trial of the Doman-Delacato Method, failed to confirm the validity of their method. He also states that "verifiable, empirical evidence from carefully controlled studies is needed if the rationale is to be taken seriously by the scientific community". Suffice it to say that the Doman-Delacato Method of Patterning as a

treatment for brain damage is still very controversial and more evidence is needed to evaluate this method.

PROGNOSIS OF MINIMAL BRAIN DYSFUNCTION:

Although the majority of the children with minimal brain dysfunction will show improvement with cerebral maturation,[47] a few may become almost autisic with a psychotic withdrawal from their environment.[15,25] Even though ordinarily the child with the syndrome will become completely compensated by age 15 to 18,[44] the improvement of the neurological picture may occur without modification of the perceptual difficulties.[18] Some other workers feel that those children who in particular show anti-personal behavior may in later years become juvenile delinquents.[74]

A 20 year follow-up study of eleven children with minimal brain dysfunction by a group at John Hopkins[51] found hyperactivity still present in three; psychosis in four; mental retardation in two; and eight were self supporting. The best indication of prognosis which this group had was the intelligence test, as they found all of those who were self-supporting had intelligence quotients which were greater than 90.

SUMMARY

The syndrome of minimal brain dysfunction is characterized:

by behavioral irregularities such as hyperactivity, emotional lability, and impulsivity, occuring in a child with scholastic underachievement, but normal intelligence. He usually suffers from perceptual motor impairment and general coordination deficits, and may also have disorders of memory, thinking, speech and hearing. Equivocal neurological signs and electro-encephalographic irregularities are less commonly present. The multi-speciality approach is used in both diagnosis and treatment.

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