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**CHILDHOOD DYSPRAXIA:
SOME ISSUES FOR THE NHS**

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PREFACE

This review has three key characteristics. First, it is not intended to be a systematic review. It is, however, structured. A number of information sources have been used. These sources include structured searching of appropriate electronic databases and web sites; interrogation of national research agendas and HTA work programmes; discussions with identified researchers in the field and, early and ongoing discussions with local 'experts'.

Second, it is written to inform non-experts in the field. We have endeavoured to use non-technical language wherever possible.

Third, the first draft was delivered to the commissioners of the review within four months of starting. Clarification of further questions to be answered was obtained and the report amended in light of these.

Childhood Dyspraxia: Some Issues for the NHS

Executive Summary

1. The Condition

- The term *dyspraxia* is used to describe symptoms of clumsiness or poor motor co-ordination. This is part of the spectrum of disorders which includes *developmental co-ordination disorder* and *clumsy child syndrome*.
- Dyspraxic symptoms are frequently associated with neurological illness or brain injury. However, health and education professionals have begun to use the term to describe a specific developmental disorder of childhood: children who display marked and persistent clumsiness or poor motor co-ordination, in the absence of any organic disorder, are increasingly diagnosed as *dyspraxic*. Our review focuses on this more recent definition of dyspraxia.
- Although there is a proliferation of such labels, some of which tend to be used interchangeably in the literature, their precise meanings differ in subtle but important ways. Strictly speaking, use of the term *dyspraxia* indicates that motor problems result from an inability to effectively plan and sequence movements. However, the term is often used to describe a general clumsiness problem.
- The prevalence of childhood dyspraxia has been estimated at around 6%. Boys are four times more likely to be affected than girls.
- The precise causes are unknown, but the condition is believed to be developmental and may be associated with neurological immaturity. Risk factors include prematurity and a family history of dyspraxia or other developmental disorder.
- The key symptoms are clumsiness, poor motor co-ordination, lack of movement fluency, and an inability to apply motor skills mastered in one setting to different situations. There may also be problems with visual perception and spatial awareness.
- Dyspraxic children tend to have poor attention spans, and many exhibit speech problems. In pre-school children, dyspraxia may manifest as a delay in reaching developmental milestones (e.g. prolonged “bottom shuffling” or lateness in walking).
- The movement problems experienced by children with dyspraxia limit their ability to “join in” with other children, leading to lack of self confidence and social isolation. Academic achievement and family life may also be affected.
- If the condition is particularly severe, or if the child is unable to develop strategies to cope with and compensate for their physical deficits, behavioural problems may result. Dyspraxia can thus have a devastating psychosocial effect on children and their families.

2. Identification and Management

- Early diagnosis is highly desirable, as treatment is more likely to succeed if started in the infant or pre-school stage. However, evidence suggests that GPs and health visitors are still largely unaware of the condition, and tend to attribute parental concerns about

developmental delay to over-anxiety. In many cases the problem only becomes apparent once the child starts school and their performance is compared against that of other children.

- Health service provision for the recognition and diagnosis of children with dyspraxia varies across the country.
- There is no standard approach but treatment usually involves referral to physio-, occupational or speech therapy services, depending upon the child's needs and local arrangements.
- Waiting times can be long and resources are limited. Specialist, multidisciplinary provision for dyspraxia is rare, although there are notable exceptions, such as the therapy programmes offered by the Child Development Centre at Addenbrookes Hospital, Cambridge.
- A number of standardised assessments have been developed to help teachers identify children with motor impairments.
- The route into treatment for many school-age children is through procedures laid down by the local education authority (LEA). As set out in the Department of Health's 1994 Code of Practice, LEAs are responsible for the identification and assessment of children with special educational needs. Thus many dyspraxic children receive help and support within the school setting, with any additional professional input funded and co-ordinated by the LEA.
- There is evidence to suggest that the level of help and support provided to dyspraxic children varies from school to school, and that few schools have a coherent strategy for dealing with the problem. An exception to this rule is found in County Durham, where primary schools are currently running a specially designed assessment and remediation programme.
- Although research suggests that intervention is worthwhile, there is little conclusive evidence on the relative effectiveness of treatments for dyspraxia. Rigorously designed RCTs are rare within the biomedical and psychological literature.
- Several NHS-funded research programmes into childhood dyspraxia and related conditions are currently under way, including one systematic review.
- Reports on various therapeutic training programmes have also appeared in the educational literature. Here research has been dominated by case studies and uncontrolled before-and-after evaluations.

3. Conclusions

- Dyspraxia is not thought to be "curable", but early diagnosis, treatment and educational support can help children substantially overcome their motor difficulties.
- Given the importance of appropriate and timely referral, there is a need to raise awareness of the disorder among GPs, health visitors and other professionals who deal with pre-school children in the community.
- The prevalence of dyspraxia is relatively high. A figure of 6% would suggest that, on average, there will be at least one affected child in every school class.

- More rigorous research into the effectiveness of treatments is needed. Dyspraxia research is an area where health and education professionals should collaborate.
- NHS provision for the diagnosis of dyspraxia is currently patchy.
- There is evidence to suggest that pre-school and school-based approaches might offer the best therapeutic way forward. However, the level of help offered within the education sector is not consistent.
- Research is needed to identify the most effective and cost-effective setting for treatment. It will also clarify the most appropriate role for NHS services and health professionals.
- There is an urgent need for closer collaboration between the health and education services in the management of these children.
- Professionals need to work more closely and sympathetically with parents. Dyspraxia can place major psychosocial stresses on the parents and families of children with the condition.

Childhood Dyspraxia: Some Issues for the NHS

Introduction to the Review

This review is based on recent literature in the fields of education, social services, medicine and health service management. Relevant papers were identified via online searches of the following databases :

MEDICINE,

HEALTH AND SOCIAL CARE :

Cochrane Library

Embase

HMIC

Medline

National Research Register

PsycLit

EDUCATION :

British Education Index

Eric

The term *dyspraxia* is often used as a catch-all to describe symptoms of clumsiness or poor motor co-ordination. Dyspraxic symptoms are frequently seen in adults and children affected by neurological illness or brain damage. However, among health and education professionals, the term dyspraxia is increasingly being used to describe a specific developmental disorder of childhood. Children who display clumsiness or a lack of physical co-ordination, in the absence of any apparent organic disorder, are frequently diagnosed as dyspraxic.

Our review concentrates on this more specific definition of dyspraxia as a condition in its own right. It also discusses related or synonymous disorders such as *developmental co-ordination disorder* and *clumsy child syndrome*. Such labels tend to be used interchangeably in the literature, although their meanings differ in subtle but important ways. It is estimated that around 6% of children show signs of dyspraxia. Precise causes are unknown, although there is evidence to suggest a relationship with neurological immaturity.

In addition to motor difficulties, dyspraxic children may experience low self-esteem, social isolation and poor academic achievement. There may also be a link with behavioural problems.

1. THE CONDITION

1.1 Childhood Dyspraxia – Definitions

Dyspraxia is a developmental disorder affecting motor abilities in otherwise normal, healthy children. The term indicates that the problem lies with “praxis”, i.e. the ability to plan and execute movements is impaired. Children with dyspraxia appear clumsy or awkward (Sugden & Wright, 1995).

Definitions have varied over time according to context and professional viewpoint. The concept of “developmental clumsiness” has been with us for over 60 years (Orton, 1937). However, it was research carried out in the 1970s and 1980s, such as that by Gordon and McKinlay (1980), that truly began to advance clinical understanding. It was in a mid 1970s work on the phenomenon of the “clumsy child” that Gubbay defined dyspraxia broadly as an impairment of movement ability in mentally normal children (Gubbay, 1975).

In later years, occupational therapists such as Chu and Milloy refined the definition of dyspraxia as a breakdown of “praxis”, the ability to utilise voluntary motor abilities effectively in everything from play to the performance of skilled tasks (Chu, 1987; Milloy, 1993). The educational psychologist Madeleine Portwood has refined the definition further, classifying dyspraxia as “motor difficulties caused by perceptual problems, especially visual-motor and kinaesthetic motor difficulties” (Portwood, 1996). In 1994, the first UK inter-professional forum on dyspraxia was unable to arrive at a definition acceptable to all represented professions: however, two suggestions were made:

- “In the absence of any known neurological condition or intellectual impairment, dyspraxia is the inability to plan, organise and co-ordinate movement. It results in fine and gross motor problems and/or speech difficulties”.
- “Dyspraxic children are those who, in the absence of physical and/or neurological disorder, have difficulties in control and co-ordination of voluntary motor activity. The condition is developmental rather than acquired” (Brown, 1994).

Some authors have identified two elements to the disorder: *ideational* or *planning dyspraxia*, and *ideo-motor* or *executive dyspraxia*. The former primarily affects the planning, sequencing and co-ordination of motor activities; the latter hinders fluency, speed and skill. Most dyspraxic individuals display both elements, and many have additional problems with spatial and directional awareness. The diagram shows the inter-dependence of planning, execution and sensory awareness in the performance of voluntary movements:

ENVIRONMENT

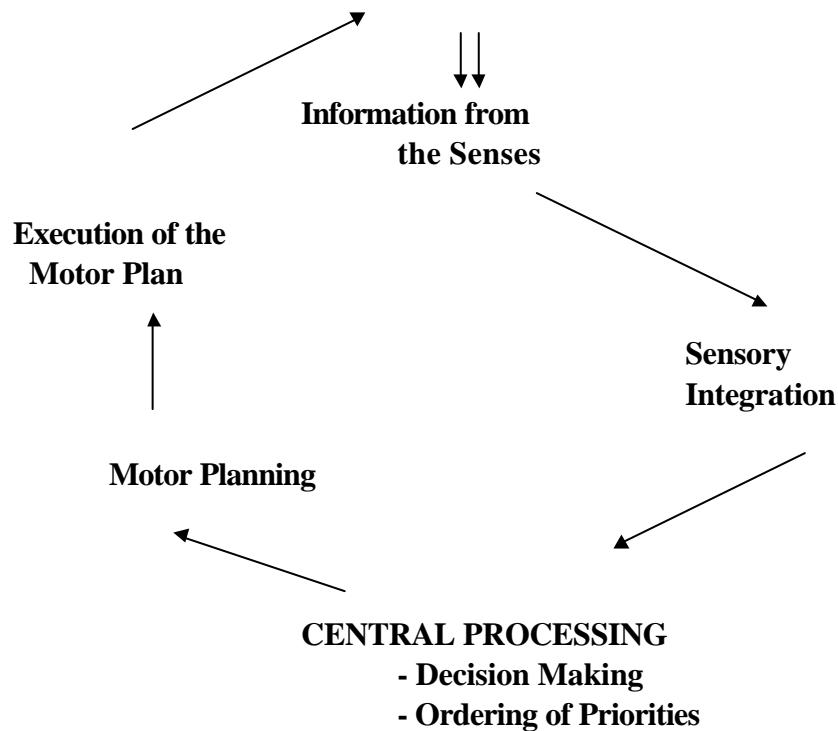


Fig.1: the “feedback loop” for efficient praxis. From Ripley et al (1997), p.6.

1.2 Synonyms

Movement difficulties in children cover a wide spectrum of symptoms and severity, and there tends to be inconsistency in the terminology used. Children may simply be described as “clumsy” or “awkward”, but more descriptive terms include *developmental dyspraxia*, *perceptuo-motor difficulties*, *apraxia*, *minimal brain dysfunction*, *neurological soft signs* and *developmental co-ordination disorder*. All these terms are to some extent synonymous with dyspraxia.

The term *developmental co-ordination disorder* (or DCD) is used by the American Psychiatric Association as the official DSM-IV term for motor co-ordination problems in children (American Psychiatric Association, 1994). It is frequently encountered in the US literature. However, DCD is often used to describe a more generalised movement disorder. As dyspraxia refers primarily to problems in sequencing and organising movements, which not all children with DCD exhibit, care needs to be taken when terms like dyspraxia or apraxia are equated with DCD (Miyahara & Moebs, 1995). Indeed, this proliferation of synonyms is confusing to parents and professional alike. Although each of these terms has a subtly different meaning and, strictly speaking, describes a different subgroup of children, they are often used in the literature as if interchangeable (Missiuna & Polatajko, 1995). There is a need for clearer definitions and a more consistent and disciplined use of terminology in this area.

It should also be noted that terms like “dyspraxia” and “DCD” are now considered more acceptable than the earlier “clumsy child syndrome”. Many professionals consider that labelling children with the word “clumsy” is derogatory and unhelpful (McGovern, 1991).

1.3 Prevalence

Estimates of the prevalence of dyspraxia vary according to setting and author, with most placing the figure between 5% and 10%. For instance, Gubbay (1975) quotes 6%. In the UK it is estimated that dyspraxia affects approximately one child in twenty, and research has suggested that around 6% of all children have difficulties severe enough to require intervention (Portwood, 1996). This means that, on average, there will be at least one dyspraxic child in every school class. Boys are more commonly affected than girls by a ratio of around 4:1 (Gordon & McKinlay, 1980). Symptoms and severity vary from child to child, and it has been suggested that around 2% of dyspraxic children are severely affected.

1.4 Aetiology & Possible Mechanisms

The precise cause of dyspraxia is unknown. The condition is believed to result when neurones in the right hemisphere of the brain fail to form precise pathways as the brain develops. This leads to a lack of accuracy when the brain instructs the body to perform movements, resulting in clumsy, poorly co-ordinated actions.

A mechanism for why this happens has been proposed by Portwood (1996), based on the theories of the biologist Gerald Edelman (1989; 1992) and the developmental psychologist Esther Thelen: infants are not genetically pre-programmed with all the motor skills they need, but have to establish them for themselves through a process of trial, error and reinforcement. The acquisition of motor skills depends upon the formation of efficient neural pathways for the transmission of instructions from brain to limbs. As the developing infant experiments with movements, connections between neurones in the cerebral cortex are reinforced as a result of “successful” outcomes (such as grasping a toy or balancing a brick) because the movement sequences that lead to success are practised again and again. In short, neuronal links form as the infant consolidates motor movements. In dyspraxic children, it is suggested that this reinforcement of neuronal connections in the cerebral cortex is somehow impeded, leaving the brain in a state of immaturity. Thus the dyspraxic child is slow to process motor instructions and lacks fluency of movement.

Other authors describe dyspraxia as primarily a “disorder of gesture” and offer a neuropsychological explanation (Dewey, 1995; Morris, 1997).

Several researchers have investigated the impact of neurological immaturity on children displaying symptoms of dyspraxia. One study involving dyspraxic children aged 5-13 has suggested that delayed maturation of axial structures has an adverse effect on perception of spatial relationships and body position. As a result, such children can orient themselves only to their own body and the immediate surrounding space (Ishpanovich-Radoikovich, 1993).

Research has also been carried out comparing the perceptual and motor processes of dyspraxic children with those of normal children and of adults with apraxia caused by brain damage. Skorji and McKenzie (1997) carried out a comparative study to assess the ability of “clumsy” children to reproduce simple sequences of movements. They concluded that clumsy children’s ability to memorise modelled movements is more dependent on visuospatial rehearsal than that of normal children. In a case-control study carried out by US occupational therapists, it was found that the movement errors made by children and young people with developmental dyspraxia were similar to those made by adults with acquired apraxia caused by left hemisphere brain damage (Poole et al, 1997). This suggests that the praxis behaviours of the two groups are similar, although the cause of the problem differs.

1.5 Risk Factors

Risk factors for dyspraxia may include prematurity, post-maturity, perinatal problems and a family history of dyspraxia or other developmental disorders (Gubbay, 1978). There is evidence to suggest an association between clumsiness in children born prematurely and abnormalities of the corpus callosum (Mercuri et al, 1996). The possibility of a link between prematurity or complications at birth and the development of dyspraxia or neurological problems in later life is currently the focus of much debate.

1.6 Symptoms

The key symptoms of dyspraxia are clumsiness and lack of physical co-ordination. Dyspraxic children lack fluency even when basic movement skills have been mastered, and they have difficulty in adapting skills to different situations. This lack of adaptability hinders their capacity to learn games and play with other children. They may also exhibit problems with self care and activities of daily living. The severity of symptoms varies: some dyspraxic children develop considerable competence in many areas and learn to compensate for their skill deficits, whilst in others, poor motor ability is part of an overall picture of delayed development. Research involving Singaporean children with DCD demonstrates that children with these kinds of problems should not be thought of as a homogenous group (Wright & Sugden, 1996). During this study the researchers observed that subjects fell into four distinct sub-groups, each exhibiting slightly different perceptual and motor

deficits. Severity of overall impairment also varied between the four sub-groups. Movement problems may have knock-on effects on social and family life, and on academic achievement. The frustration and feeling of failure such children experience at their lack of prowess and inability to “join in” may lead to low self-esteem, alienation and behavioural problems.

1.7 Specific Motor Difficulties

In normal children, gross motor tasks such as catching or kicking a ball are usually mastered before fine motor tasks, such as threading a needle or copying letters. Children with dyspraxia tend to experience problems across the whole range of motor activity. However, some dyspraxic children have a high level of control over fine motor tasks but have difficulty with the gross motor skills required for school P.E., or vice versa. When observed carefully, many of their difficulties appear to lie in planning or sequencing the movements required by a particular action: they may try to correct earlier mistakes at an inappropriate point in the movement sequence, leading to confusion and loss of fluency. Problems may be exacerbated when the child is put under time pressure. Mildly dyspraxic children who perform well at home and during play often start to experience problems when they enter school and are increasingly expected to complete tasks within set time limits.

When a child with dyspraxia carries out a motor task, associated or “mirror” movements are sometimes observed in limbs not directly involved in the action being performed (Portwood, 1996). For instance, jumping or hopping might be accompanied by unnecessary arm movements; or when the right hand throws or catches a ball, the left hand may make similar gestures. Associated movements of the legs and feet, such as swinging or tapping, may be observed as the child is seated at a table performing fine motor tasks (e.g. playing with constructional toys). This may indicate that the brain messages governing movement are not travelling along the optimum neural pathways.

Hand dominance in many dyspraxic children remains undecided to a comparatively late age, and posture tends to be poor. There may be problems with visual perception (e.g. difficulties in judging distances; a tendency to write letters and numbers backwards so that pairs like “d” and “b” are confused). Some dyspraxic children also experience speech problems, as their motor processing difficulties can affect the articulatory abilities of the mouth and tongue (Stackhouse, 1992). Hand-eye co-ordination, listening skills and attention span may be below those expected for a child of similar age. Problems with spatial awareness and kinaesthesia (the awareness of movement and body position) make dyspraxic children prone to bumping into objects and people. This may lead to disruption in the classroom and name-calling in the playground.

1.8 Impact on Academic Achievement

Children with dyspraxia may have difficulty in reaching the attainment targets laid down by the National Curriculum. Problems with writing and organising information on the page will hinder progress in academic subjects like English and mathematics, while poor co-ordination may limit success in music, design technology and art or craft subjects (Curry, 1991). It is therefore extremely important that the condition is recognised early in the child's school career.

There is also a link between motor impairment and dyslexia. Children with dyslexia tend to exhibit characteristic difficulties with balance and motor skills, and there may be considerable overlap between those regarded as dyslexic and those labelled dyspraxic. The relationship between the two conditions is further underlined by recent research involving adult dyslexics, suggesting that dyslexia, like dyspraxia, is associated with abnormalities in the cerebral cortex (Nicolson et al, 1999).

1.9 Behavioural Problems

With regard to the link between dyspraxia and behavioural problems, there is some disagreement as to the nature of the relationship. One study concluded that dyspraxic children were no more prone to behavioural problems, hyperactivity, aggression or antisocial activity than their classmates, and that such problems were more likely to lie in the child's social circumstances (Shaffer et al, 1985).

Research carried out in Sweden suggests a link between motor control problems and attention deficit hyperactivity disorder (ADHD); a population study of seven year olds identified a significant symptom overlap between children diagnosed as ADHD and those with DCD (Kadesjo & Gillberg, 1998). Children who displayed symptoms of both disorders had a higher incidence of behavioural problems than those with ADHD or DCD alone. In Scandinavia, children who suffer from this combined disorder - which is known as DAMP ("*deficits in attention, motor control and perception*") - have been the focus of several longitudinal studies (Sugden & Wright, 1998).

However, most authors acknowledge that the stress, isolation and loss of confidence experienced by children whose clumsiness sets them apart from their peers is likely to have an adverse effect on behaviour. One educational psychologist found that, in a group of 107 children requiring special education or even residential provision because of their behavioural difficulties, 77% exhibited signs of neurological immaturity (Portwood, 1996). In subsequent research carried out at the Deerbolt young offenders' institution in Durham, she applied simple screening tests to a group of 67 juveniles and identified 41 (61.2 %) as dyspraxic. Of these, 19 (48%) were severely affected (Matheson, 1997a & 1997b). Thus the prevalence of dyspraxia among juvenile offenders appears to be very much

higher than the 5-10% quoted for the general population. It has been suggested that children whose dyspraxia remains unrecognised and untreated and who fail to reach their full academic and social potential at school are likely to become disaffected and alienated, and are thus at greater risk of drifting into delinquent or criminal behaviour such as truanting, drug taking and theft.

1.10 Effects on Family Relationships

A recent study examined the ways in which dyspraxia affects parents and families (Chia, 1997). It found that parents' understanding of the condition tended to be poor, usually because they had been given little information by professionals. Parents reported that their dyspraxic children required a much higher level of care than "normal" siblings. At school, they felt that large class sizes prevented teachers from giving dyspraxic children the individual care they needed to keep up with other pupils. The social lives of both parents and children were adversely affected by having a dyspraxic child in the family, and parents reported feeling isolated and stressed. It was suggested that the parents' feelings of helplessness, anger and depression were similar to those observed in parents of children with chronic illness or severe learning disabilities.

Other research has observed that parents tend to treat children with motor difficulties differently from their "normal" siblings, leading to tensions within the family (Chesson et al, 1990). Families have also reported that dyspraxic children who experience difficulties at school often vent their frustrations on parents and siblings in the form of bad behaviour in the home (Gibson, 1996).

Chia (1997) concludes that, although dyspraxia is primarily a disorder of motor co-ordination, it also has major psychosocial effects on children and their families. She recommends that interventions include an element of emotional or social support for the family in addition to physical therapy for the child. Daly (1992) stresses the importance of sympathetic management in schools and offers advice to parents on handling the emotional aspects of the problem at home (e.g. how to explain the problem to the affected child and their siblings).

1.11 Prognosis

Whether or not dyspraxic children “grow out of it” as they get older remains unclear. Some studies suggest that many manage to adapt and develop strategies to compensate for their lack of motor skills, or that motor skills improve with age (Knuckey & Gubbay, 1983). Other research has argued that, without help, most dyspraxic children continue to exhibit poor co-ordination and tend to have a disappointing academic record and low self-esteem in adolescence (Losse et al, 1991), and may even be more prone to anxiety disorders (Shaffer et al, 1985). The message is clear: as it is not possible to predict which children will learn coping strategies, all dyspraxic children need help. There is a little published evidence on the effectiveness of treatments for childhood dyspraxia in the biomedical literature: however, studies carried out in educational settings suggest that intervention is worthwhile and can help children overcome or compensate for their motor skills deficits.

2. IDENTIFICATION & TREATMENT

2.1 Spotting the Signs of Dyspraxia

The Dyspraxia Foundation has published guidelines describing some of the more common signs in otherwise healthy children (Ormell, 1996). In addition to general clumsiness and lack of physical co-ordination, the signs to look out for are as follows:

In the pre-school child:

- A history of lateness in reaching developmental milestones such as sitting, walking, speaking, etc.
- Physical co-ordination so poor that the child cannot run, hop, jump, play with a ball, etc. in an age appropriate manner
- Inability to dress or use a knife and fork properly
- Poor pencil grip
- Significant difficulties with jigsaws, shape sorting games, Lego, construction toys, etc.
- Very immature artwork
- No understanding of positional concepts such as in/on/behind/in front of, etc.
- Tendency to be anxious, excitable and easily distracted
- Difficulty in keeping friends or judging how to behave in company

In the school-age child:

- Persistence of pre-school problems, with little or no improvement
- Avoids or is poor at P.E.
- Does badly in class but significantly better on a one-to-one basis
- Poor attention span
- Difficulty in following/remembering verbal instructions, or in following more than one instruction at a time
- Reacts to stimuli without discrimination
- Problems with maths, spelling and reading
- Handwriting is slow, laborious and immature
- Major difficulties in copying from the blackboard

Although many “normal” children will show some of these signs at some time in their lives, in dyspraxic children the pattern will be pervasive, persistent and severe.

2.2 Assessment & Screening Instruments

There are several standardised assessments for identifying paediatric motor disorders. Probably the most commonly used is the Movement Assessment Battery for Children (Henderson & Sugden, 1992). Sometimes referred to as the “Movement ABC”, this is a comprehensive assessment package specifically designed for children. However, as the Movement ABC and similar assessments can take over an hour to complete, they are more appropriate as diagnostic rather than screening instruments. In response to the need for a relatively simple screening instrument suitable for use by teachers, the educational psychologist Madeleine Portwood has developed the Motor Skills Screening test, which can be administered in around 20 minutes (Portwood, 1996). The test assesses motor competence and co-ordination, and is designed to identify children aged 7+ who are experiencing movement difficulties consistent with dyspraxia. The results of the motor screening test together with a cognitive assessment and the developmental history of the child may form the basis of a diagnosis of dyspraxia. Portwood suggests that cognitive assessment is carried out using the Wechsler Intelligence Scale for Children (Wechsler, 1992). Another author has piloted a behavioural screening instrument to enable school teachers to identify children with DCD (Dussart, 1994).

For further discussion of the assessment of movement difficulties in children, see Sugden (1991) and Henderson (1987). Any assessment made by an educational professional should be backed up by a medical examination to rule out any serious health problems.

2.3 Diagnosis

Clinical diagnosis should involve careful screening to exclude underlying neurological or physiological causes. Pre-school children may be diagnosed as dyspraxic by GPs or paediatricians because parents, having noticed that developmental milestones are not being reached, have persistently sought health service intervention. However, motor difficulties are frequently not spotted until the child starts school. In the school environment, problems with structured activities like writing, cutting, constructing and P.E. routines become more noticeable because comparisons can be made with “normal” children.

It is important that dyspraxia is diagnosed as early as possible. Treatment is believed to be more successful if started early, and teachers are more likely to respond positively during early years education. Children with motor difficulties are less likely to be labelled as disruptive as the early years curriculum is based on an understanding of child growth and development. In addition, children identified as dyspraxic at the infants stage will probably encounter less hostility from fellow pupils for appearing “different” or for receiving special treatment.

Some authors have warned of a possible class bias in the diagnosis of dyspraxia (McGovern, 1991). They argue that parents in higher social classes are less likely to be fobbed off with an assurance that the child will simply “grow out of” their clumsy phase. They will insist that the underlying causes are identified, and push for the child to receive attention from teachers and therapists. Thus the problems caused by dyspraxia may be compounded by social disadvantage, with less fortunate children being diagnosed later or not at all. These children’s problems may then be misinterpreted by primary and secondary teachers, leading to their being perceived as merely disruptive or attention-seeking.

2.4 Referral Routes for Pre-School Children

GPs routinely see pre-school children whose perceived lack of motor skills and delayed development are causing their parents concern. In many cases the parents’ worries are unfounded. However, some parents feel that GPs do not take their concerns seriously, adopting a “wait and see” strategy which fails to live up to their expectations of an instant solution. It has been suggested that GPs are more likely to take early action if parents present with a list of specific concerns (Sugden & Wright, 1995). These might include: activities with which the child has marked and persistent difficulty when compared with other children of the same age; and the continuance of specific behaviours which are no longer age appropriate.

A concerned GP will then refer the child on to a consultant paediatrician, or to the local child development centre. If dyspraxia or DCD is diagnosed the child may be assigned to receive occupational therapy (OT) or physiotherapy:

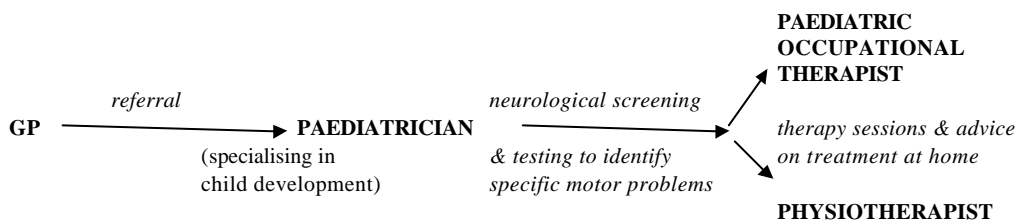


Fig. 2: referral route for pre-school children

The provision of occupational therapy and physiotherapy for children varies across the country, and specialist provision for children with dyspraxia is rare. Referral to NHS therapy services may therefore involve significant waiting times, depending on the resources available from the local health authority. If the movement and co-ordination difficulties manifest as speech problems, the child may be referred to a speech and language therapist.

Parents often share their initial concerns with a health visitor. GPs and health visitors therefore play a crucial role in the early diagnosis of dyspraxia and in providing prompt access to therapy and advice. However, recent research carried out by the Dyspraxia Foundation indicated that only 3% of diagnoses were made by the child's GP, and that health visitors largely failed to notice the problem (Dyspraxia Foundation, 1997). In addition, although the majority of parents were aware of difficulties by the time the child was three, the average age of diagnosis was six and a half. This suggests that primary care professionals urgently require training and advice to enable them to recognise the symptoms of dyspraxia.

2.5 Referral Routes for Children of School Age

The route into treatment described above is still possible, but the needs of older children are more likely to be met through procedures laid down within the school situation. The 1994 Code of Practice offers guidance to local education authorities (and governing bodies of grant maintained schools) on their responsibilities for the identification and assessment of children with special educational needs (Department for Education, 1994). All schools should have a policy on such children and, ideally, a named teacher responsible for co-ordinating resources (the Special Needs Co-ordinator, or SENCO). The Code of Practice emphasises the importance of inter-agency collaboration and states that "it is essential that schools, local education authorities, the health services, social services, voluntary organisations and other agencies work very closely with each other, and that all work closely with parents".

The Code of Practice is grounded in the developmental perspective, taking as its starting point teachers' concerns about individual children's progress towards key developmental goals. It recommends a five-stage assessment model for children with special needs. The first three stages are school-based and involve teachers, parents and the SENCO. Stage One simply consists of the child's teacher sharing her concerns with parents, finding out about the child's developmental history and adapting the teaching programme to help the child achieve specific goals. Stage Two involves the drawing up of an Individual Education Plan with set targets and a timetable for monitoring and review. At Stage Three the school may call on the help of an external specialist (in the case of dyspraxia, this is likely to be an educational psychologist, speech therapist or paediatrician).

During Stages Four and Five, responsibility is shared by the school and the local education authority. At Stage Four the SENCO, with the parents' consent, may request a Statement of Special Educational Need under the 1993 Education Act (Great Britain: Parliament, 1993). The child is then subjected to formal multidisciplinary assessment, reports are prepared and the parents' views are sought. Representatives of the local education authority consider the evidence and decide whether to proceed with Stage Five, the "statementing" process itself.

The first three stages form a continuous and systematic cycle of planning, action and review. In the case of the dyspraxic pupil, the aim will be to improve the child's movement skills to a point where they can participate fully in all school activities. External expertise is introduced as required. A child may have all their needs met at Stage One, or go all the way through to Stage Five. At all stages the success of the process depends upon close co-operation between professionals, parents and agencies. For more information on the procedures laid down by the Code of Practice see Sugden & Wright (1995) or Ripley et al (1997).

A child who is "statemented" under the Education Act 1993 will receive extra help provided and funded by the local educational authority. This may take the form of additional hours of teaching and will be in addition to any health service intervention the child already receives. Children who suffer from very severe dyspraxia, or whose problems are exacerbated by disturbed behaviour, may be taken out of the school system altogether and put into special education.

2.6 Interventions for Dyspraxia

As previously outlined, interventions take three main forms: school-based assistance, therapy and/or special education administered by the local education authority; NHS services provided by health professionals such as OTs and physiotherapists; and exercises the child can work through at home under parental supervision. Some children will receive interventions from more than one source simultaneously.

2.6.1 School-based interventions:

Assistance offered to dyspraxic children of school age might include:

- individual attention
- extra tuition in problem subjects
- provision of laptops or keyboards for written work
- speech therapy
- special physical exercises or P.E. routines
- help from a classroom assistant and/or special needs teacher
- provision of a sloping desk and/or easy-grip pencils for handwriting
- extra time for homework or exam revision
- social skills training
- general encouragement and confidence building

The Dyspraxia Foundation's recent survey suggests that the help offered to dyspraxic children varies widely and that few schools have a strategy for dealing with the problem (Dyspraxia Foundation, 1997). However, some local education authorities are approaching the problem in a coherent manner: in County Durham, 82 schools are currently running programmes devised by Madeleine Portwood, the senior educational psychologist for the

county. Having carried out extensive research into dyspraxia, Ms. Portwood has developed a comprehensive school-based approach to meeting the needs of dyspraxic children. Her programme includes assessment tools and remediation activities to improve motor skills (Portwood, 1996). Treatment is tailored to the requirements of different age groups. Ms. Portwood's programmes have been very highly rated by schools and parents, and controlled evaluations have yielded encouraging results (Portwood, 1996).

School-based programmes have several advantages: the child can be treated within the course of the school day, thus minimising the disruption and stigmatisation associated with taking time off to see NHS therapists; many remediation activities can be integrated into the school curriculum and worked through by the whole class (e.g. in P.E. lessons); dyspraxic children can receive school-based treatment more frequently than they would be able to see an OT; and the problems of waiting for assessment and treatment that would be encountered in the NHS are avoided. School-based programmes may also be more cost-effective.

2.6.2 Health service interventions:

As described above, NHS treatment for dyspraxic children is provided primarily by OTs, physiotherapists and/or speech therapists, according to local resources. Provision varies from place to place, and few health authorities or trusts appear to have a comprehensive strategy for the treatment of dyspraxia. Coherent, effective programmes are available in some areas (e.g. at Addenbrookes Hospital in Cambridge), but demand outstrips supply and waiting lists are long.

2.6.3 Home-based activities:

Home activities supervised by parents are often used to complement formal interventions. They are designed to "bridge the gap" between formal sessions and to help maintain improvements. Home activities should be as varied as possible, and are most effective when carried out "little and often".

In addition, several free-standing treatment programmes have been designed for home use. These may be particularly useful for parents who are unable to find a suitable programme for their child, as the availability of school-based programmes varies from area to area, and referral to NHS therapists may involve long waiting times (see: Cocks, 1992; Ripley et al, 1997; Sugden & Wright, 1995).

2.7 Private Provision

In addition to the approaches outlined above, parents who are informed and financially able may seek private care for their child. There are three main options:

- Individual treatment offered on a private basis by mainstream health professionals (e.g. physio-therapists practising privately).
- Complementary approaches such as brush therapy (see Matheson, 1997b), cranial osteopathy, etc.
- Specialist centres, e.g. as the Dyscovery Centre* in Cardiff.

The Dyscovery Centre opened in September 1997 and is the first clinic to offer a “one stop shop” for the assessment and remediation of individuals who may be dyspraxic, dyslexic, or have a specific learning difficulty of some kind. At present it runs as a private practice and so individuals and their families pay for the services they use. As facilities for children with dyspraxia are limited and the demand is huge, private practitioners and enterprises like the Dyscovery Centre could be seen to fill an important gap in services; unfortunately, the cost puts them out of the reach of most families.

2.8 “Where’s the Evidence ?” - Interventions for Dyspraxia Evaluated: Examples from the Literature

The majority of examples come from the educational, rather than the biomedical, literature. Studies involving clearly described randomisation and control groups are comparatively rare; case studies and informal evaluations predominate. In addition, subject groups vary from study to study, being variously described as dyspraxic, clumsy, DCD etc., and diagnostic criteria are often inadequately described.

Laszlo and Bairstow (1985) have written extensively about the concept of *kinaesthesia*. They define kinaesthesia as that sense which provides the individual with information about the position of the body; the direction, extent and speed of movements; and the pressure and force that muscles exert. As kinaesthesia is essential to skilled motor performance and is not fully developed until later childhood, it is argued that clumsiness and poor co-ordination in children results from a lack of kinaesthetic ability, or *dyskinaesthesia*. Based on these ideas, the authors have developed a form of therapy known as the *process orientated approach*. Unlike task orientated methods, which involve repeated practice of specific motor skills, the process orientated approach aims to improve the underlying perceptual and motor processes. In a randomised trial involving 40 clumsy children aged between seven and twelve, the process orientated approach was compared with traditional task-based motor skills training (Laszlo, Bairstow &

* the Dyscovery Centre can be contacted on 01222 788 666

Bartrip, 1988). The results suggested that the process orientated approach is both more efficient and more effective than task orientated methods.

However, other authors have questioned the superiority of the programmes developed by Laszlo et al. One study pointed out methodological shortcomings in the above evaluation of the process orientated therapy. It set out to evaluate the kinaesthetic approach developed by Laszlo et al using a case control (matched pair) design with an untreated control group (Sims et al, 1996a). The results were unexpected: improvements were observed in both groups, with the training programme appearing to have had no differential effect. It was concluded that use of the Parameter Estimation by Sequential Testing (PEST) procedure (Elliott et al, 1988) as an outcome measure may have significantly improved the subjects' motor competence regardless of group assignment. The effects of PEST testing are explored further in a later paper (Sims & Morton, 1998).

In a second attempt to evaluate Laszlo's kinaesthetic training programme, Sims et al (1996b) carried out a randomised trial comparing Laszlo's method against task-based cognitive-affective training, and against no treatment. Significant improvements in motor competence were observed in both treated groups, but the kinaesthetic group showed no advantage. The authors concluded that the presentation of remediation programmes for clumsy children may be as important as their actual content.

A further (and more rigorous) randomised controlled trial evaluating the process-orientated approach was carried out by Polatajko et al (1995). This trial compared Laszlo's approach with individualised programmes of "traditional" occupational therapy, and with no treatment. The subjects were 74 children with DCD who had been referred for occupational therapy. All were assessed before and after treatment, and at follow-up after six weeks. The results were mixed; they suggest that these children do not improve spontaneously, and that their motor and co-ordination problems are very resistant to treatment. The authors concluded that a more appropriate treatment strategy might involve direct, repetitive training in specific motor skills

An interesting example of a collaborative intervention with input from both health and education professionals took the form of a week long multidisciplinary course for children aged between five and eight. The children were recruited from local schools where they had been identified as clumsy and poorly co-ordinated. The course consisted of complementary, structured activity programmes led respectively by a physiotherapist, an occupational therapist, a speech therapist and special needs teachers. There was also input from an educational psychologist. Although evaluation of the course was informal and subjective, it was observed that all the children who attended increased in confidence and made improvements in at least one basic physical skill. All but one appeared to make friends. Other benefits included better awareness among class teachers, increased support for parents, and strengthened inter-professional links (Venables, 1988).

Wright and Sugden (1995) describe a school-based intervention programme for Singaporean children with DCD. Interventions were delivered by the children's own teachers during normal school hours. The five-week, task-orientated programme was based on activities outlined in the Movement ABC manual (Henderson & Sugden, 1992). Each child was treated on an individual basis. Although not subjected to controlled evaluation, all participants displayed some improvements post-intervention. The authors conclude that DCD can be successfully managed in the school setting, provided that individual needs are carefully considered. They believe that treatment may be effectively delivered by teachers and incorporated into the school day, with only the most severely affected children requiring OT or physiotherapist intervention.

A pre- and post-treatment study from the Netherlands suggests that clumsy children can benefit from individualised physiotherapy. Eighteen children, identified by school doctors as having considerable problems with co-ordination, were selected for intervention. Each child was observed for three months (during which no spontaneous improvement occurred) before commencing a three month course of physiotherapy. The programme was based on sensorimotor training, which is similar to the perceptual-motor programme developed by Kephart (1960), one of the most frequently used methods in the Netherlands. After the course, significant improvements in motor skills were observed. The improvements were maintained at follow-up three months after the intervention ceased (Schoenmaker et al, 1994).

Both Nash-Wortham (1987) and Tempest & Parkinson (1993) report case studies of work undertaken with children described as poorly co-ordinated or dyspraxic, and having speech and literacy problems. The former describes the progress made by a 10 year old girl following a school-based remediation programme. The programme involved co-ordination-improving exercises (during normal gym lessons) and individual sessions consisting of relaxation, breathing and muscle exercises, reading aloud, writing practice, spelling and vocabulary work. The latter study describes an intensive multisensory intervention designed for an 11 year old boy with severe dyspraxia and reading difficulties. This tailor-made programme was administered by a speech and language therapist in close liaison with the child's support teacher. Both programmes appeared to be effective.

In their review of interventions for children with DCD, Sugden and Chambers (1998) discuss some of the key approaches and assess their effectiveness. They conclude that most interventions work (to some extent), leading to significant improvements compared with control group or pre-treatment measures. However, there is little evidence as to which approach - whether task-orientated, process-orientated, or other - is the most effective. Sugden and Chambers suggest that positive effects may owe more to general learning principles (such as accurate assessment and tailored, individual attention) than to the specific content of the intervention. It is an area where more research is needed.

2.9 Ongoing and Recently Completed Research

Within the education sector, a number of local education authorities are currently evaluating the structured motor skills programmes developed by Madeleine Portwood (Portwood, 1996). Within the health service, several studies have been carried out at the Child Development Centre based at Addenbrookes Hospital in Cambridge. These include a study of the needs of severely dyspraxic children (ongoing), an evaluation of therapy programmes offered to “clumsy” children in the East Anglia region, and a comparison of combined OT/physiotherapy interventions with physiotherapy alone (both complete but as yet unpublished).

Other ongoing projects include: a case control study of the cognitive, social and behavioural profiles of clumsy children, based at Great Ormond Street Hospital; an investigation of diagnostic and treatment outcomes at an experimental dyspraxia clinic offering OT programmes, based at Stepping Hill Hospital in Stockport; and an assessment of screening procedures for identifying children with DCD, based at the Royal Aberdeen Children’s Hospital. In addition, researchers at the Institute of Child Health are carrying out a systematic review on the effects of OT on children diagnosed with DCD.

2.10 Simple Steps for Improving the Motor Abilities of Dyspraxic Children

Whether the child is receiving formal intervention or not, simple actions that parents, primary school and P.E. teachers can take include:

- encouraging the child to adopt a better sitting posture
- breaking physical activities down into very simple movement components
- playing games that emphasise control, e.g. where movements are slowed right down or stopped on command (e.g. “slow motion” and “statues” games)
- being aware that dyspraxic children may benefit from individual attention in an unpressured environment before they can participate satisfactorily in group activities in the playground or gym
- encouraging reflection and problem-solving, e.g. “Do you need to throw the ball higher/softer/harder?”. “Do you think your writing looks better when you hold the pencil more/less tightly?”
- pointing out and praising improvements

2.11 Support for Parents

The main source of support is the Dyspraxia Foundation*, set up in 1987 to help individuals and families affected by developmental dyspraxia. It also aims to increase public understanding and awareness. The Foundation provides information and resources for parents, as well as skills training for children. A network of local support groups has been set up, along with a special group for adult dyspraxics and a newsletter for teenagers with the disorder. The Foundation also maintains a website and runs a dyspraxia telephone helpline.

In 1997, the Dyspraxia Foundation launched a media campaign to mark its tenth anniversary and raise the profile of dyspraxia. As part of this campaign, the Foundation carried out a survey of its 454 members (Dyspraxia Foundation, 1997), concentrating on awareness and diagnosis of the condition. This provides an interesting snapshot of the experiences of parents with dyspraxic children. For instance:

- Only 25% of children had been diagnosed by the time they began school
- Around 66% of parents reported that schools offered no help or insufficient help when diagnosis was first made
- Most schools tended to become much more supportive once the condition had been officially diagnosed
- Approximately 46% of members' children had been statemented by the local education authority

The Foundation concluded that, although the situation appears to improve once the child has a legitimate diagnostic "label", more needs to be done to raise awareness of the condition among education professionals.

* the Dyspraxia Foundation can be contacted at 8 West Alley, Hitchin, Herts, SG5 1EG, or telephone the Dyspraxia Helpline on (01462) 454 986. There is also a Website at <http://www.emmbrook.demon.co.uk/dysprax/homepage.htm>.

3. CONCLUSIONS

Dyspraxia is not thought to be “curable”, but early diagnosis, treatment and educational support can help children substantially overcome their motor difficulties. Prompt diagnosis is therefore vital, but evidence suggests that GPs and health visitors have poor awareness of the condition. Although demand for treatment is high, NHS provision is patchy and waiting times can be long. There is evidence to suggest that school-based intervention provides an effective and cost-effective solution; however, the availability of school programmes varies considerably.

More research is needed on the effectiveness of treatments for dyspraxia, and also on the most appropriate role for health services and NHS professionals. School-based strategies might offer the best way forward, and there may be much to learn from some of the innovative approaches being undertaken in County Durham. There is an urgent need for closer interdisciplinary co-operation between health and education services, both at the organisational level and between individual professionals with child development expertise. Professionals should also work more closely with parents, and attention must be given to the psychosocial needs of parents and families of children with dyspraxia.

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