Dyspraxia

Dyspraxia is a somewhat enigmatic and poorly defined term for children with gross and/or fine motor coordination problems that cannot be explained by a known medical condition (although this does not mean that they have normal neurological function). The terminology used is highly variable, and confusing. Other or similar terms include “clumsy child syndrome”, “developmental dyspraxia”,”minimal brain damage” (MBD), “developmental coordination disorder” (DCD), “deficits in attention, motor control, and perception“ (DAMP). There may be subtle differences among these terms, but in practice there is little to distinguish them(Gibbs et al., 2007).There is a move to use the term developmental coordination disorder (DCD) (American Psychiatric Association, 2013), but the term dyspraxia is still commonly used (which we will continuehere).

Dyspraxia is not rare; it probably affects about 6% of children (Gibbs et al, 2007), but estimates vary from 1.4 to 19.0% (Deng et al., 2014), and 4 time more likely in boys. Historically, the child with dyspraxia has been later diagnosed with a wide range of neurological conditions (Gibbs et al, 2007).Supposedly, dyspraxia is not due to a general medical condition (such as cerebral palsy) and is not Pervasive Developmental Disorder (Zwicker et al, 2012).There is also an association with other disorders including dyslexia, dyscalculia, dysgraphia, ADHD and also autism (Dziuk et al., 2007), which can make diagnosis difficult (Barnhart et al., 2003) . Depending on the main type of motor deficit, various subtypes have been identified, including:

- ***Ideomotor Dyspraxia***Difficulty in completing single step motor tasks, such holding a fork or pen, ball throwing, jumping, climbing stairs, carrying books, etc.
- ***Ideational Dyspraxia***Difficulty in completing sequence of movements such as tying shoe laces, brushing teeth, getting dressed, writing, typing on a computer keyboard, playing sports.
- ***Oromotor Dyspraxia (verbal apraxia, apraxia of speech)*** Difficulty in coordinating muscles to pronounce words that are difficulty to understand (even by parents)
- ***Contructional Dyspraxia***Difficulty in understanding spatial relationships, such as arranging items, copying/drawing geometric shapes, craft work.

The cause of dyspraxia is unknown, but prematurity (<37 weeks), low birth weight, a positive family history, and maternal alcohol/drugs during pregnancy are known associations. Periventricularleukomalacia (PVL), a focal brain damage that occurs in pre-term infants, is a known cause of visual and cognitive deficits. When the cortico-spinal tracts are also involved, motor deficits also occur, and interestingly, there is

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also a strong association with constructional dyspraxia (Koeda et al., 1997). The cerebellum, pre-frontal cortex, and the striatum have been implicated (see Deng et al., 2014). Thus, an underlying brain abnormality is likely. The possibility of some overlap, or confusion, with ocular motor apraxia should be kept in mind.

Effects

Motor coordination in daily activities is substantially below normal - given the child's age and measured intelligence. It includes delayed motor development (late walking, crawling and sitting), clumsiness, poor performance in sports and poor/slow handwriting. The condition is sufficiently severe as to interfere with academic achievement and daily living.

Dyspaxia was traditionally thought to be a benign transitory phenomenon of early childhood. Today it is recognised that dyspraxia can have significant social and emotional difficulties, such as difficulty in joining in group activity (e.g. sports), lack of fitness, and awkwardness can invoke bullying and ostracismleading to social withdrawal, behavioural problems, low self-esteem and academic under performance.

Diagnostic

Diagnosis can be made by a wide range of health professionals, including paediatricians, neurologists, clinical psychologists, and educational psychologists.

A quarter of dyspraxic children will have been diagnosed in the pre-school years, typically instigated by concerned parents, but diagnosis is difficult before the age of 4 years. The remaining 75% emerge in primary school years, when clumsiness persists, and poor handwriting skills do not improve. Thus, it cannot be assumed that the parents or teachers know that a particular child is dyspraxic.

Interventions

Numerous interventions have been proposed, and they have been reviewed a number of times (Pless&Carlsson, 2000; Mandich et al, 2001; Barnhart et al., 2003; Polatajko et al., 2006. Unfortunately, the reviews are quite disparate in how the different interventions have been classified, and there is a lack of cross-referencing, implying a lack of consensus.Nevertheless, there is increasing evidence that the

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more recent “top-down” approaches are superior to the more traditional “bottom-up” approaches.

Bottom-up Approaches

The idea behind bottom-up approaches is motivated by theoretical considerations of motor hierarchy. Complex movement are based on simpler motor and sensory components, so that practice/training on components should bring about an overall improvement in motor control at a higher level. However, supporting evidenceis weak.

Sensory Integration (SI)

This approach assumes that motor skills (and other cognitive skills) depend on sensory integration, including proprioceptive, tactile and vestibular input. The key to SI is full body movements and training in specific perceptual and motor skills. This was originally proposed by Ayres (1989), but numerous comparisons have failed to show much if any long term improvement in dyspraxic children (see Mandich et al., 2001).

Process Oriented Treatment

It has been proposed that dyspraxia reflects a kinaesthetic deficit – the child has reduced sensitivity to her own movements (Laszlo &Bairstow, 1985).Intense practice in kinaesthetic tasks was proposed by Laszlo, as well as positive feedback and adapting to the child’s ability. Children show motor improvement when compared to controls with no intervention, but there is little evidence to support that it is due to the kinaesthetic training per se. Rather it is probably the positive feedback and raised motivation (Sims et al., 1996)

Perceptual Motor Training

This approach combines both sensory and motor training and claimed to be better than sensory integration and process oriented training, but meta-analysis of many studies does not support this, at least in dyspraxia (Kavale et al, 1983).

Top-Down Approaches

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The top down approach is to intervene at the task level, rather than at sensory and motor components. The goal is to learn the task.

Task Specific Intervention

In this approach as task is broken down into steps. Each step is trained, and the steps are then brought together to form the original task. Positive results have been shown (Mandich et al., 2001), although there is little information on the generalisability of this approach.

Cognitive Approach

Cognitive interventions introduce an active component via the so-called *Cognitive Orientation to daily Occupational Performance* (CO-OP) approach (Miller et al., 2001; Barnhart et al., 2003):

- **G**oal: What am I going to do:
- **P**lan: How am I going to accomplish the skill
- **D**o it: Go ahead and perform the skill:
- **C**heck: How well didmy plan work?

The role of the therapist is to *guide the child to discover which aspect of the task are presenting problems and how to overcome these problems. This is done by a process of asking questions of the child, such as "what is going wrong?", "How did you do that?", What do you need to first?", or "how might you fix that?"*(Miller et al, 2001). Clearly, the key is to overcome the anosognosiaof dyspraxia by guided self-discovery. However, it is important to maintain motivation.

To our knowledge, tablets have not been exploited specifically for dyspraxic children. Nevertheless, here are many potential avenues to explore. Handwriting and typing skills could be recorded and tested. Pointing can be addressed. Even balance and stability could be recorded via accelerometers. However, a top-down approach (task specific and cognitive) would seem to be the most successful.

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