Current perspectives on minimal cerebral dysfunction

Children with minimal cerebral dysfunction (MCD) are a large client group for many paediatric physiotherapists. The increasing number of research papers published in the area of MCD are often complex and difficult to interpret because the children to whom they refer do not form an easily definable, homogeneous group and their prognosis is unclear. This review presents a summary of current findings about MCD and poses a number of questions about physiotherapy intervention. The need for physiotherapists to validate their role in the management of children with MCD is emphasised.

Key words: Brain; Child Behaviour Disorders; Child Development Disorders; Pediatrics

Children with minor sensory motor difficulties are a heterogeneous group, a fact reflected by the descriptive rather than diagnostic terminologies applied to them, including minimal cerebral dysfunction (MCD), minimal brain dysfunction (MBD) and minor neurological dysfunction (MND). Definitions differ somewhat but there is general agreement on the central problem being one of impairment of motor skills not attributable to any identifiable or overt physical or intellectual disorder (Henderson 1987).

For convenience, the term minimal cerebral dysfunction (MCD) will be used in this paper as it is a term which commonly appears in the Australian physiotherapy literature (Bullock and Watter 1978 and 1987, Watter and Bullock 1987a). Children with MCD, often labelled clumsy by concerned parents and teachers, have recently attracted increasing recognition and interest in both the literature (Henderson 1993) and the media. This attention has highlighted the fact that sensory motor problems in children are significantly associated with antisocial behaviours and poor learning (Gillberg et al 1989) which may well have an ongoing negative impact on these children as they reach adulthood.

Physiotherapists have traditionally been among the many service providers for children with MCD, promoting better sensory motor function as a foundation for improved physical performance and greater self-esteem and establishing a better basis for learning (Watter 1982). In the current economic climate, physiotherapists must clarify and justify their role in ameliorating the short term effects of MCD and demonstrate their contribution to improving long term outcomes.

Features of MCD

The reported incidence of MCD is high, ranging from 5 to 20 per cent of school-aged children depending on the definition applied (Gillberg et al 1989), with boys affected outnumbering girls by at least three to one (Bullock and Watter 1987).

Symptoms of MCD characteristically occur in clusters and may include combinations of poor gross and fine motor function, poorly developed postural control and dysfunction in one or more of the sensory systems (Watter 1984). Difficulties with gross motor skills often become evident in the early school years, with the increasingly complex demands of age-appropriate physical activities. If children with MCD are able to achieve age-appropriate motor tasks, they may do so using poor movement quality and compensatory strategies (Watter 1984). These compensations may lead to poor postural patterns and muscle imbalances, increasing the potential for injury and later musculoskeletal...
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problems. While this is obviously an area of concern to physiotherapists, identification of common postural problems in MCD and the most effective approach to their management remains poorly researched.

Growing evidence has indicated that children with MCD have problems processing, storing and utilising sensory information for efficient motor output (Lord and Hulme 1987, Schoemaker and Kalverboer 1990, van der Meulen et al 1991). These difficulties have been attributed primarily to inaccurate feed-forward control processes (van der Meulen et al 1991). Feed-forward mechanisms utilise only efferent information to fine tune movement patterns, so that dysfunction may result in less efficient pre-programmed movement and therefore greater reliance on afferent feedback.

Children with MCD often develop secondary emotional and behavioural problems which may include hostility and aggression, frustration, rapid mood swings, withdrawal and depression (Bullock and Watter 1978, Hadders-Algra et al 1988c). Both parents and teachers have rated children with MCD as having significantly more introverted and negative social behaviours than control children at a primary school level (Kalverboer et al 1990).

Sensory motor dysfunction appears to significantly impair children's ability to learn and the presence and severity of MCD has been found to relate significantly to poor performance on standardised reading, spelling and arithmetic tests (Gillberg and Gillberg 1989). Children with MCD may often avoid sporting activities, thereby reducing their strength and fitness to below that of their peers. Poor performance and achievement in educational and sporting arenas are likely to have a profound impact on the social and vocational prospects of the child with MCD, so that while the motor dysfunction may be minimal, the impact on the child and their community may be major.

Aetiology and prognosis

The aetiology of MCD is multifactorial with prematurity, low birthweight and neonatal neurological symptoms being identified as strong predictors of marked clumsiness up to nine years later (Hadders-Algra et al 1988b and 1988c). The significance of these risk factors appears to be magnified in the presence of lower socio-economic status and interval complications during the second year of life (Hadders-Algra et al 1988b and 1988c). Recent research applying multivariate analysis to the range of risk factors identified in perinatal histories and abnormal symptoms at nine years suggests that there may be aetologically and clinically distinct subtypes of MCD (Hadders-Algra et al 1988a). If further scientific evidence supports the existence of discrete subgroups under the umbrella of MCD, physiotherapists may need to investigate whether particular treatment approaches are more effective for different groups.

The prognosis of children with MCD is widely debated due to the many different criteria used to identify MCD and measure its outcome (Henderson 1993). There have been few longitudinal studies of the behaviour of symptoms over time to provide scientific evidence for or against the common belief that children will outgrow clumsiness (Losse et al 1991). One exception to this is the work of the Gillbergs and their colleagues in Sweden, who have followed the natural history of a cohort of children diagnosed with MCD in an epidemiological study commenced at six years of age (Gillberg and Gillberg 1989, Gillberg et al 1989). These researchers found that in their study group, clearly detectable motor problems seemed to decline after 10 years of age (Gillberg et al 1989). A disturbing finding was that far higher rates of behavioural and school achievement problems persisted to 13 years of age in the study group, compared with the control group (Gillberg and Gillberg 1989).

While there appear to be subsets of the MCD population which have a less favourable prognosis than others, the reasons for variation in prognoses remain poorly understood (Gillberg and Gillberg 1989, Losse et al 1991). The psychological literature suggests that the child's temperament and the nature of family dynamics may help to determine how well the child copes with a biological disadvantage such as MCD. The child with a more resilient personality in combination with a structured home environment may fare better (Losse et al 1991). As the child grows older, decreased motivation and lack of practice may increasingly interact with motor competence (Henderson 1993). These factors may contribute to eventual outcome in the child with MCD.

Assessment

Few assessments for children with MCD are well standardised, particularly for older children and teenagers (Losse et al 1991). The relationship between performance on clinical and laboratory-based test items and the child's function in everyday life remains to be established, an issue which has been termed ecological validity (Losse et al 1991, Schoemaker and Kalverboer 1990). A recent evaluative study of physiotherapy for children with MCD suggested there was some transfer effect from treatment activities to the untreated skills in the motor test administered before and after three months of therapy (Schoemaker et al 1994).

However, it is more relevant for physiotherapists to examine in further detail whether gains made by the child in the therapeutic situation sufficiently equip the child with MCD to meet new movement challenges in their daily life.

From a physiotherapy perspective, many of the motor tests designed by neurologists lack sufficient emphasis on quality of movement and, in particular, on the role of the sensory systems. Australian physiotherapy researchers have developed a neurodevelopmental physiotherapy assessment which has been modified for children with MCD (Burns and Watter 1974, Watter 1984). This assessment grades the child's performance.
performance in the areas of fine and gross motor coordination, postural control, reflex activity and sensory function (Watter and Bullock 1987a and 1987b). It is important that children with MCD be identified early so that their sensory motor difficulties can be treated and ensuing behaviour and learning problems reduced as much as possible. A study utilising this neurodevelopmental physiotherapy assessment established that poor test performance at eight months accurately predicted motor difficulties at four years of age (Burns et al 1987) and continuing research in the area of early detection of MCD is warranted.

Physiotherapists often argue that their intervention contributes to substantial improvements in confidence and behaviour in the child with MCD (Schoemaker et al 1994, Watter and Bullock 1987a). However, little attempt has been made by physiotherapists to measure these changes. It would be useful for physiotherapists to consider the inclusion of short rating scales of confidence and behaviour in their assessment and re-assessment of the child with MCD. A number of these scales, which record subjective ratings by the child, parents and teachers, are already published in the psychological literature (Kalverboer et al 1990).

Intervention
The major approaches which have evolved in the management of MCD are educational, behavioural and neurological. Special educators have obviously concerned themselves mainly with the child’s learning difficulties and physical educators have focused on skills training and fitness, while psychologists have tended to address disorders of behaviour. As motor difficulties are among the most common problems encountered in children with MCD, physiotherapists have had an important role in management, traditionally based on a neurological approach which often also incorporates elements from the disciplines of psychology and education. Physiotherapy intervention for children with MCD has tended to emerge from treatment approaches originally designed for other client groups.

It seems that in practice many physiotherapists adopt an eclectic sensory motor approach to suit each child’s specific needs by combining components of neurodevelopmental therapy and the sensory integration approach (Ayers 1972), with some skills-based and fitness training through age-appropriate games and functional activities (Schoemaker et al 1994, Watter and Bullock 1989). Physiotherapists need to keep reviewing the theoretical basis of their treatment choices for children with MCD in the light of contemporary research findings. One pertinent example is the growing research focus on theories of motor control which look at the processes, both motor and cognitive, which are common to the performance of all movements (Schoemaker and Kalverboer 1990). Recent preliminary studies of therapy for children with MCD support the idea that training the processes underlying the movement dysfunction is more effective than specific skills training (Schoemaker and Kalverboer 1990). Such research findings can promote a better understanding of physiotherapy intervention, helping physiotherapists to justify treatment methods which previously may have been based largely on empirical success.

Many other questions face physiotherapists in their efforts to provide both effective and efficient intervention for children with MCD. Studies evaluating the efficacy of physiotherapy for children with MCD have demonstrated that significant sensory motor gains can be made following an average of six months of treatment (Bullock and Watter 1978, Schoemaker et al 1994, Watter and Bullock 1987a and 1987b). One study found children had improved after only three months, with treatment effects maintained for a further three months. However, in that instance, treatment was provided individually for 45 minutes twice a week (Schoemaker et al 1994). In practice, some physiotherapists may be unable to deliver such an intensive program due to workload constraints and in any case, many parents are not happy to have their child withdrawn from school for such periods. Other studies have shown that monthly treatment sessions accompanied by specific home activities over a period of six months also resulted in significant gains in children with MCD, which were maintained following a further six to 12 months without intervention (Bullock and Watter 1978, Watter 1982, Watter and Bullock 1987a). Significant educational gains have also been recorded following the physiotherapy treatment of children with MCD (Watter 1982).

While it is encouraging that the effects of physiotherapy intervention appear to be maintained for up to 12 months following the cessation of treatment, the stability of treatment effects and impact on the child’s behaviour and school achievement in the longer term are worthy of further study. It is assumed to be desirable to commence intervention as early as possible for children with MCD. Perhaps it is necessary for physiotherapists to evaluate whether treatment outcomes vary significantly according to the age at which the child is referred for physiotherapy intervention. Findings could then be incorporated into advice to referring agencies, decision-making about the optimal length of treatment for particular children and reinforcement of the importance of early physiotherapy intervention.

Summary
MCD is one of many umbrella terms applied to a cluster of sensory motor problems adversely affecting a child’s ability to function at home or at school. Children with MCD are a large client group at risk of developing behavioural, emotional and learning difficulties. The potential impact on not only the child, but also on their family, teachers and community, is a cause for concern. Physiotherapy programs for children with MCD have been shown to ameliorate neurological problems at least in the short term,
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thereby promoting the child’s self-esteem and ability to learn and participate in social and sporting activities. However, despite increasing knowledge regarding some aspects of MCD and its management, a number of questions remain unanswered, providing a clinical research challenge for physiotherapists involved with this diverse group of children. In the current competitive health care market, physiotherapists must strive to substantiate their particular role in improving the longer term outcome of MCD.

References


