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WE CAN CURE YOUR CHILD'S CLUMSINESS! A REVIEW OF INTERVENTION METHODS

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ABSTRACT. Intervention procedures for treatment of clumsiness have come in many guises. We have looked at some of the most powerful methods put forward in the past 30 years—Perceptual–motor training (PMT), Sensory Integration Therapy (SIT), and some promising new approaches. Both the PMT and the SIT have been heavily criticised. It is hard to find support for the idea that the programmes improve academic skills or that they have more than a limited effect on perceptual–motor development as claimed. The more recently introduced Kinaesthetic training is shown to have an effect on general motor competence but that this may be better explained in terms of the general principles on which this training procedure lies rather than the influence on Kinaesthesis *per se*. Since other recent studies have also shown a dependence on similar general principles, it might be asked whether it is the teacher rather than the programmes that accounts for the differences shown between different intervention programmes.

Key words: clumsiness; intervention; kinaesthetic training; perceptual–motor training; physiotherapy; sensory integration therapy; task-specific training.

INTRODUCTION

The term "clumsy children" seems to have first been used by Orton (30) and since that time has entered into general usage (40). Nevertheless, in the interim period there has been considerable debate over the nature of the syndrome and, consequently, a definition which would adequately embrace the problems with which such children are confronted in everyday life. Henderson (18), an active researcher in this field, chooses to adopt the definition provided by the American Psychiatric Association in the *Diagnostic and Statistical Manual of Mental Disorders* (1). The condition is there labelled Developmental Coordination Disorder (DCD) and described as *a marked impairment in the development of motor coordination that is not explicable by mental retardation and that is not due to a known physical disorder.*

In this article we will retain the term clumsiness, or motor impairment, because these terms will probably be more familiar to readers than this more recent term. Moreover, the potential extent reference of the new terminology might question its usefulness. The 6% estimate of school age children in Norway exhibiting "clumsiness" (29, 37, 43) is very similar to the estimates made in other countries, the general range reported being 5–10% (1, 7, 16, 19). In the absence of intervention the syndrome will likely continue to manifest itself, although there may be some alleviation over the years (9, 14, 27). In addition, a number of related problems in the social and cognitive domains may reveal themselves (18, 27, 35). Clearly, there is still a fundamental need for intervention programmes, both for children and adults, based on empirically supported theoretical approaches in order to reduce the immediate socio-economic burden on the state and future expense in terms of insurance premiums, hospitalisation and institutionalisation.

Intervention procedures have over the years come in many guises. We will take a closer look at some of them, starting in the 1950s–1960s with methods grouped by Kavale & Mattson (21) as perceptual–motor training, continuing with sensory integration theory and therapy (2), and ending with more recent studies which have shown promising results (25, 34, 36, 39). In so doing, it is important to keep in mind that in spite of the fact that most definitions of the "clumsiness" syndrome include the waver "... that is not due to a known physical disorder", co-morbidity (related deficits) is of constant concern when looking for explanations of the phenomenon. Gillberg & Gillberg (15), for example, rightly draw attention to the high incidence of motor problems in children with, for example, attention deficits and hyperactivity disorders. For this reason, in the following studies discussed, sample selection will be commented upon with this problem in mind.

In the 1950s–1970s the interest in motor problems *per*

se was not that pronounced, although the fact that motor programmes figured prominently in intervention procedures designed to remediate learning disabilities (10) implied recognition of their potential significance in other areas. In this review the attempt was to include studies designed to explore motor behaviour in the context of learning disabilities as well as those that purport to be directed towards motor problems *per se*. The latter have gone to considerable trouble, often through extensive testing, to avoid confounding that which might be introduced by the presence of comorbidity.

PERCEPTUAL-MOTOR TRAINING

Perceptual–motor training embraces a variety of different intervention procedures based on the contention that not only are perceptual qualities and motor abilities functionally linked, but *causal* relations can also be demonstrated between them. From such a departure point it has been proposed that one might change perceptual abilities and academic functioning by encouraging children and adolescents to engage in prescribed movement tasks (10).

In 1983, Kavale & Mattson (21) presented a metaanalysis of over 180 studies making use of a variety of perceptual–motor programmes (selected from over 600, those without control groups being rejected for this purpose). The findings for the developers and users of such programmes were not encouraging. In general, no improvement in academic skills was found, and only very modest effects on perceptual–motor abilities.

SENSORY INTEGRATION THERAPY (SIT)

The term "sensory integration" was defined by Ayres (2) as *the ability to organise sensory information for use*, its function as an intervention procedure being to improve academic learning as well as motor skills. The approach differs from many other procedures in that it does not, according to Ayres, teach specific skills. The objective is to enchance the brain's ability to master such skills. The argument put forward, in this respect, is that if the brain develops the capacity to perceive, remember and motor plan, these abilities can then be applied in the mastery of academic and other tasks, regardless of their specific content. The objective would appear to be modification of the neurological dysfunction interfering with learning rather than attacking the symptoms of that dysfunction *per se* (2). While sensory integration therapy (SIT) has been criticised by many, perhaps the most comprehensive critique comes from Cratty (10) in his overview of sensory–motor and perceptual–motor theories and practices.

His critique of the whole "movement movement" (sensory–motor and perceptual–motor theories) is directed at their concern with movement as a means of aiding academic performance, less interest being shown in movement as a means of aiding movement.

In addition to the critique of the theoretical framework on which SIT is based, Ayres' studies in particular come under the spotlight. Cratty claims that support for sensory integration theory is limited, and evidence for the efficacy of SIT difficult to find. The latter critique is supported by many efficacy studies. Polatajko et al. (32), for example, in their review of 20 years of SIT literature, conclude that no support is provided for SIT as an effective treatment for the academic problems of learning-disabled children. With respect to *sensory or motor* variables, they state that it is not clear whether SIT is any more effective than perceptual–motor approaches. Cummins (11) offers critique to the Ayres' statistical evidence. His conclusion is that the available data do not provide validity for either the theory or the treatment methodology advocated by Ayres.

In the face of this kind of evidence it is somewhat surprising, therefore, to find Ayres, and her co-workers (3), as late as 1987 reaching the conclusion that there is support for the idea of a general visuosomatopractic function with the elements linked by concept formation and of additional, differentiated, practical skills defined by behavioural goals (p. 107).

KINAESTHETIC TRAINING

The idea that "clumsiness" might stem from poor kinaesthetic sensitivity has recently received a considerable amount of attention. In 1981, Bairstow & Laszlo (4) first reported that 8 out of 14 "clumsy" children they tested in their Kinaesthetic Sensitivity Test were "... kinaesthetically blind". The test comprised two components: one designed to test kinaesthetic acuity, and the other designed to test kinaesthetic perception and memory.

However, Doyle et al. (12) have questioned the procedures used by Bairstow & Laszlo (4) in developing their test. Bairstow & Laszlo investigated the relation between their kinaesthetic test and measures of movement skill. They reported, for example, a significant correlation between kinaesthetic performance and a writing task (4). Subsequently, Elliott et al. (13) and

Sugden & Wann (42) presented data that are inconsistent with these findings (18).

The intervention methods of Laszlo et al. are process-oriented. Their aim is to diagnose the cause of the difficulties underlying the overt symptoms, this cause being a defective process or ability. Improvement of such a defective process would lead to acquisition and better performance of those tasks which are dependent on the process. Improvement in a limited number of processes would then facilitate acquisition and skilful performance on many tasks (25). One of these processes, kinaesthesis, is considered by Laszlo et al. to be of fundamental importance in the acquisition and performance of all motor tasks, and intervention should therefore concentrate on improving this specific process. In their 1988 study, Laszlo et al. (25) presented results which suggested that those children who were trained on the two components of the Kinaesthetic Sensitivity Test improved dramatically on the Test of Motor Impairment. Those who received other kinds of intervention did not. Polatajko et al. (33) tried to replicate the Laszlo et al. studies (25, 26). Their results were mixed. It seemed that the outcome of the training was dependent on the variable being examined. The "Laszlo group" did not score better than either the group receiving traditional treatment or the control group, receiving no training, on any other variable than kinaesthetic acuity, the task on which children in this group were trained. They suggest, therefore, that an appropriate treatment strategy might be direct, repetitive training of specific skills, since in their data, where this strategy was used, the treatment had a clear and strong effect.

This critique would not, however, appear to have been taken into account as, in their 1993 study, Laszlo & Sainsbury (24) came to the same conclusion that improvement in kinaesthetic sensitivity generalises to motor performance.

COGNITIVE AFFECTIVE TRAINING

Cognitive affective training has been put forward not as a new method of intervention but as a general set of principles applicable to any method of training. It was introduced in a study by Sims et al. (39), who carried out two investigations to evaluate the efficacy of the kinaesthetic training (KT) used by Laszlo et al, (25). In the first study they used, as did Laszlo et al., two groups of subjects, both of which were tested on the Kinaesthetic Sensitivity Test (KST) and the Test of Motor Impairment (41). One of the groups received kinaesthetic training and the other received no training. Sims et al. (38) found significant improvements on the Test of Motor Impairment for both groups, there being no difference between the groups in this respect. Both groups also improved in kinaesthetic sensitivity, but here the KT group improved more than the control. They came to the conclusion that these improvements in motor ability could be attributed to the KST procedure itself. The procedure used was that of Parameter Estimation by Sequential Testing (PEST), first described by Taylor & Creelman (44) and refined by Penland (31). This might have served as a training method as the threshold in this procedure is approached stepwise with success on one level being followed by a more difficult task (narrower ramp separation) and failure leading to an easier task (wider separations of the ramps). It would seem that Laszlo et al.'s programme and the PEST shared common principles.

Overall, the Laszlo programme involved four general principles: (1) it is intensive—daily sessions over a short period of time; (2) the level of difficulty is set so that the child can manage the task, and the difficulty of the task is gradually increased as a result of the child's success; (3) frequent positive feedback is given; and (4) self-monitoring of daily achievements is encouraged in the child. On the basis of these principles Sims et al. devised a set of tasks for children, so-called Cognitive affective training. The aim was to change the content of intervention programmes while as far as possible maintaining identical training procedures.

In their second study, Sims et al. (39) compared cognitive affective training to kinaesthetic training using a control group with no training. Matching was carried out using the method of Constant Stimuli rather than PEST. The results showed that both the kinaesthetic training group and the cognitive affective training group improved significantly on the Test of Motor Impairment, relative to the control. The control group made no significant improvements on any measures. Sims et al. concluded that the improvement in the experimental groups must have been due to the general principles which formed the basis for both the kinaesthetic and cognitive affective training, rather than to the programmes themselves. However, the cognitive affective training group, unlike the kinaesthetic training group, did not show improvement on kinaesthetic sensitivity. Thus, kinaesthetic training has two effects: a specific kinaesthetic effect and a general motor effect. The cognitive affective training, in contrast, only produces the general effect.

PHYSIOTHERAPY

A recent study in the Netherlands by Schoemaker et al. (36) evaluated physiotherapy for clumsy children. They focused on children whose primary problem was that of poor coordination. Their search of the intervention literature led them to conclude that there were few programmes designed specifically to treat this condition. In clinical practice, programmes originally designed for children with more general learning disabilities are used to treat clumsiness (36). Therapy, initially intended for children with cerebral palsy, is also frequently adapted for use with children with less severe disabilities (36).

The treatment provided by Schoemaker et al. was representative of that commonly offered in the Netherlands, i.e. based mainly on sensory–motor training (8), comparable to the perceptual–motor programme of Kephart (22), and the Bobath & Bobath technique (6). The programme offered is based on the contention that various abilities underlie the performance of movement skills. Treatment is directed at improving these abilities, the assumption being that development of such abilities will eventually lead to improved motor performance—an assumption that also forms the basis for the work of Laszlo et al. with respect to proprioceptive/kinaesthetic ability.

Over a period of 3 months each clumsy child was treated by a physiotherapist for 45 minutes, twice a week. All children were treated by the same therapist in order to maintain consistency of treatment approach and reduce variation in methodology. The therapist performed his own assessment and was blind to the child's performance on the Test of Motor Impairment and the ABC (General Coordination Test) (45) tests, which were carried out independently. The control group had the same pre- and post-test but did not receive any treatment between the tests. After 3 months of training, the clumsy group had improved significantly, while the performance of the control group remained the same.

It has to be appreciated here that, just as Sims et al. had demonstrated with respect to the approach of Laszlo et al., some general principles were incorporated into the Schoemaker et al. study, e.g. inducing a feeling of competence in the children, avoiding failure and providing positive feedback whenever a child succeeded in performing a movement task correctly. The exercises were also designed to have a playful character.

While any approach shown to bring about improvement in motor skill is to be applauded, it leaves Schoemaker et al. with a difficult problem of interpretation. If the programme should be shown to be effective, to what can these effects be attributed? Did intervention increase the level of motor skills of such children directly, or did it merely increase their confidence to attempt movement tasks where, previously, their behaviour had been inhibited?

TASK-SPECIFIC INTERVENTION

Task-specific intervention was put forward by Revie & Larkin (34) as a method for use with poorly coordinated children and in contrast to those methods which focus on general "abilities" or "processes". The approach is founded on the assumption that multiple subsystems must be organised and constrained in specific ways for a solution to the task to emerge (5, 23, 34). This standpoint derives from Henry's (20) earlier contention that unitary abilities such as coordination and agility are specific to the task or activity. Revie & Larkin (34), in a study designed to evaluate task-specific teaching with poorly coordinated children, used two groups which, except for the specific tasks involved, were subjected to the same general movement programme. The training period lasted for 9 weeks with a total of 16 hourly sessions. The teachers spent 10 minutes in each session teaching each of the two specific tasks selected. The remainder of the teaching time (40 minutes) was spent according to the children's needs and was documented in individual evaluations for each session.

The results supported their hypothesis, showing significant improvement in performance (for three out of four tasks) in the tasks taught, but no improvement whatsoever in the tasks which were not taught.

DISCUSSION

In this short review we have browsed through some of the most powerful intervention methods for the treatment of clumsiness put forward in the past 30 years—PMT, SIT, and some promising new studies. Where does this leave us? Perceptual–motor programmes have been heavily criticised, and on the basis of their meta-analysis Kavale & Mattson (21) find no support for the idea that such programmes have an effect on academic skills, and only limited effect on perceptual–motor development.

Sensory integration therapy, according to Polatajko et al.'s (32) review of the literature, is not an effective treatment for the academic problems of learning-disable children. With respect to sensory and/or motor variables, it is not clear whether SIT is any more effective than perceptual–motor approaches (32).

Laszlo et al.'s (25) kinaesthetic training gave significant improvement in general motor competence, but this was, according to Sims et al. (38, 39) due to some general principles on which the training procedure relied, principles which might be incorporated into any programme.

Schoemaker et al. (36) showed positive effects of physiotherapy, but refer to some general principles which might underlie the positive effects found.

Revie & Larkin (34) showed significant improvement in the tasks taught due to *task-specific training*. They also refer to some underlying principles, but these would not seem to have affected the results as they were applied to both groups involved.

Polatajko et al. (33) suggest that an appropriate treatment strategy might be direct, repetitive, training of specific skills. They also point out that in the Laszlo et al. (25) study the only variable which showed significant improvement was the task on which the children were trained.

More recently, Miyahara (28), presented a meta-analysis in which three of the four recent studies mentioned in this article, as well as the method proposed by Polatajko et.al. (33), were analysed. The Polatajko study was not included in this review because of inconsistent results.

As we have seen, most of the success of recent intervention studies can be accounted for by some general principles followed during training. In as far as these principles are very much alike, it is reasonable to ask with Miyahara (28) and Gubbay (16) if it might not be the teacher rather than the programme that accounts for the differences shown between different intervention programmes. Thus, the overall picture presented is not encouraging for those parents confronted every day with children exhibiting the clumsiness syndrome. Parents who know there is something wrong with their child often discover that it is not severe enough to merit professional intervention and, in consequence, the problem is categorised as being "within the norm". Even when intervention procedures are available, initial euphoria may, as illustrated above, turn to disappointment.

Perhaps the most encouraging statement that can be made at the present time is that it is important to initiate intervention procedures in such cases as intervention itself, regardless of the method, seems to have some positive effects. In so doing, it should not be forgotten that most of the studies reviewed, which showed a positive effect of treatment, relied on some general principles for teaching, principles that seem to be very much alike across different intervention procedures; however, even here, the teacher may be the important medium.

Clearly there is much still to learn about the origins and treatment of clumsy behaviour. Attempts to move away from global assessment procedures and global intervention procedures may be a way forward. Recently, Sigmundsson et al. (37) have concentrated their research focus on a subcategory of clumsy children, namely, those exhibiting hand–eye coordination problems. They were able to show, in a manual matching task, that the 8-year-old children with hand–eye coordination problems showed inferior performance to the control children in both inter- (visual–kinaesthetic) and intra-modal (kinaesthetic–kinaesthetic) matching. Such delays may be inherent in the system itself or, as Henderson (17) and Laszlo et al. (25) suggest, may be due to lack of visual–kinaesthetic matching experience. These different kinds of interpretation, and the attribution of causality, need to be explored further in experiments designed to tease out the subtleties of motor coordination disruption.

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