Occupational Therapy for Children with Handwriting Difficulties: A Framework for Evaluation and Treatment

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Handwriting is one of the most complex skills that is learnt and taught. It requires motor, sensory, perceptual, praxis and cognitive functions, and the integration of these functions. When the complex nature of this skill is considered, it comes as little surprise that many children experience difficulty in mastering this area.

When an occupational therapist observes that a child referred to the service is having difficulty with handwriting, it becomes necessary for the therapist to administer procedures to identify the strengths and weaknesses that will then become the basis for a remedial programme.

This article presents a conceptual framework for evaluating and treating handwriting difficulties presented by children in mainstream education with specific developmental disorder, such as dyspraxia or dyslexia. The performance components and functional performance of handwriting are briefly reviewed. Both evaluation and intervention procedures are discussed in order to guide the therapist in developing remedial and instructional programmes. The article highlights the unique role of the occupational therapist in evaluating and treating a child's functional performance of handwriting skills.

Introduction

Learning to write legibly is a major occupation of childhood (Cunningham, 1992). This intricate and complex process is one of the child's first tasks in an academic setting. Frequently, children who need to pay considerable attention to the mechanical requirements of writing have difficulty with other higher-order learning processes, such as dictation or story writing, reading, spelling, comprehension, mathematics and other academic learning.

Problems with handwriting are one of the most common reasons for referring school-aged children to occupational therapy in North America (Oliver, 1990; Cermak, 1991). In the United Kingdom, children with different specific developmental disorders (for example, dyspraxia or dyslexia), referred to the paediatric occupational therapy services, always experience difficulties in developing efficient handwriting skills. It is a common treatment area addressed by occupational therapists, who can provide important opportunities for the child to master the skill of handwriting.

This article outlines a conceptual framework which guides occupational therapists in developing comprehensive evaluation procedures and effective intervention. Background information related to the functions and dysfunctions of handwriting skills are reviewed. The performance components and functional performance of handwriting within a specific set of performance contexts is discussed through a conceptual model of practice. Procedures on evaluation and intervention strategies are outlined with information to support an evidence-based practice.

Background information

Although no comprehensive and widely accepted theoretical explanation of the handwriting process has been articulated, it is possible to identify preliminary theoretical arguments concerning functions and dysfunctions.

Functions of handwriting

Writing is an efficient way to record information and events. It serves as a tool for communication as well as a means to project feelings, thoughts and ideas. Hagin (1983) stressed that handwriting is the usual medium by which pupils convey to their teachers the progress that they have made in learning what is being taught. Illegible writing is a barrier in mathematics and could bias test grades.

Development of handwriting skills

Levine (1987, p315) viewed handwriting as 'the final common pathway, the merger of multiple developmental functions'. Despite the diverse readiness skills needed for writing, by the age of 6 or 7 years many children, via a traditional instructional approach, are fairly proficient at writing in school settings. Table 1 summarises the main stages in the development of handwriting skills (based on Kellogg, 1969; Klein, 1982; Erhardt, 1982; Department of Education and Science, 1989; Amundson and Weil, 1996).

Prerequisite skills

There are many prerequisite skills for handwriting instruction. They include the abilities to balance without the use of hands, grasp and release an object voluntarily, use the hands in a led and assisted fashion, interact with the environment in the stage of constructive play, hold utensils and writing tools and form basic strokes smoothly, and also the perception of let-

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Table 1. Developmental stages of handwriting skills

Age levels	Developmental stages
1–1½ years	■ Palmar – supinate grasp ■ Scribbles on paper ■ Types of scribbles: wavy, circular, variegated, looser variegated or combined ■ Imitates scribbles
2–3 years	■ Digital – pronate grasp ■ Imitates vertical, horizontal and circular strokes on paper ■ Imitates two or more strokes for a cross
3–4 years	■ Transits to static tripod posture ■ Copies a vertical line, horizontal line and circle ■ Traces diamond, but with angles rounded ■ Imitates cross
4–5 years	■ Static or dynamic tripod posture ■ Copies a cross, right oblique line, square, left oblique line and oblique cross ■ Copies some letters and numbers ■ May be able to write own name
5-6 years	■ Stable dynamic tripod posture ■ Copies triangle and diamond ■ Prints own name ■ Copies most lower and upper case letters ■ Begins to form letters with some control over size, shape and orientation of letters, or lines of writing
6–7 years	■ Produces legible upper and lower case letters in one style and uses them consistently (that is, not randomly mixed within words) ■ Produces letters that are recognisably formed and properly orientated and that have clear ascenders and descenders where necessary
8–10 years	■ Begins to produce clear and legible joined-up writing ■ Produces clear and legible writing in both printed and cursive styles

Based on: Kellogg (1969), Klein (1982), Erhardt (1982), Department of Education and Science (1989), Amundson and Weil (1996).

ter and orientation to printed language (Donoghue, 1975; Lamme, 1979; Klein, 1982).

Beery (1989) proposed that a child will be ready for formal instruction in handwriting if he or she manages to master the first eight figures of the Developmental Test of Visual-Motor Integration (VMI). The eight figures are vertical line, horizontal line, circle, cross, right oblique line, square, left oblique line and oblique cross. Maeland (1992) also found that visual-motor skill as measured by the VMI was significant in predicting the accuracy of handwriting performance.

Prevalence of handwriting difficulties

Difficulty with handwriting is a common problem in both children and adults. Often the teaching of handwriting is not emphasised in the early years of education and problems begin at that stage. Rubin and Henderson (1982) identified that 12% of 9-10 year old pupils in a London borough had handwriting difficulties. The secondary school curriculum makes new and complex demands on handwriting skills and pupils may be ill-prepared for those demands. White (1986) found that 10% of 11-year-olds still had handwriting difficulties. In the 1990 International Literacy Year, it was estimated that 1.6 million adults in the United Kingdom had difficulties with handwriting (Alston and Taylor, 1990).

Diagnostic terms

There are different terms being used by different medical, psychological, educational and therapy professionals to describe a child with a form of handwriting or handwriting-related difficulties. The two most common ones are 'developmental dysgraphia' and 'developmental disorder of written expression'.

Developmental dysgraphia is a written-language disorder that concerns mechanical writing skill. It manifests itself in poor handwriting performance in children of at least average intelligence who do not have a distinct neurological disability and/or an overt perceptual-motor handicap (Hamstra-Bletz and Blote, 1993). It may contribute significantly to a child's learning difficulty or disability and is a matter of both educational and medical significance (Gubbay and de Klerk, 1995).

Developmental disorder of written expression is a type of learning disorder described in the *Diagnostic and Statistical Manual of Mental Disorder, DSM-IV* (APA, 1994). The essential feature of the disorder of written expression is the failure to achieve expected writing skill as measured by individually administered standardised tests. Common symptoms include excessively poor handwriting and the inability to compose sentences or coherent paragraphs as indicated by multiple grammatical, spelling and punctuation errors (Rapoport and Ismond, 1996).

Handwriting problems are also a common feature in children with the diagnosis of developmental coordination disorder, developmental dyspraxia, developmental dyslexia or sensory integrative dysfunctions.

A conceptual model for performance in handwriting

It is important for each occupational therapist to adopt a conceptual model of practice so that systematic evaluation and treatment programmes can be implemented. Kielhofner (1992) described a model as a theoretical framework that explains some phenomena of practical concern (that is, focus), describes the theoretical arguments (that is, functions and dysfunctions) and provides a rationale and methods for evaluation and therapeutic interventions. It offers a generic outline of the domains of concern of occupational therapy.

The profession has categorised and defined itself as one that encompasses human performance components which serve as the basis for different occupational performance areas, within a specific set of performance contexts. It is recognised that the phenomena that constitute the profession's domains of concern can be categorised and labelled in a number of different ways. In this article, the information is organised into the Conceptual Model for Performance in Handwriting. Some of the terms and concepts used are based on the Uniform Terminology for Occupational Therapy, published by the American Occupational Therapy Association (AOTA, 1994).

Performance components

Performance components (AOTA, 1994) are fundamental human abilities that are required for successful engagement in performance areas. There are three performance components:

1. Sensory, perceptual, praxis and motor functions
2. Cognitive functions
3. Psychosocial functions.

There are many prerequisites to handwriting. Readiness involves different sensory, perceptual, motor, cognitive and language functions, and the complex integrations of these

functions. Awareness of the underlying functions involved and their development can provide a framework for looking at the child who is experiencing handwriting difficulty.

Levine et al (1981) identified that children with poor kinaesthetic perception could not develop the automaticity of manual handwriting. Schneck (1991) suggested that proprioceptive-kinaesthetic ability and hand preference in children with poor grip should be assessed routinely. Maeland (1992) identified that handwriting difficulties were significantly related to poor visual-motor integration and visual form perception in a group of clumsy children. According to Exner (1989), the three aspects of fine motor control that affect handwriting are isolation of movements, grading of movements and timing of movements.

Tseng and Murray (1994) studied 143 Chinese children (71 with problems and 72 without problems in handwriting) in grades 3 to 5. A battery of perceptual-motor tests proposed to measure the subskills of handwriting was administered along with a handwriting test. The results showed that (a) poor handwriters scored worse than good handwriters on most of the perceptual-motor tests; (b) visual-motor integration and eye-hand coordination contributed most to the legibility of handwriting for the total group of handwriters; (c) however, for poor handwriters, motor planning function contributed the most to the legibility of handwriting; and (d) for good handwriters, visual perception contributed most to the legibility of handwriting.

These research studies demonstrate the importance of evaluating and treating any potential deficits in the performance components, especially the sensorimotor component, of handwriting skills.

Performance areas (functional performance)

Performance areas (AOTA, 1994) are broad categories of human functional activities that are typically part of daily life. There are three performance areas:

1. Activities of daily living
2. Work/school and productive activities
3. Play or leisure activities.

Handwriting is one of the work/school and productive activities. Some controversy exists as to when children are ready for formal handwriting instruction. Differing rates of maturity, environmental experiences and interest levels are all factors that can influence children's early attempts and successes in copying letters. Some children may be ready for writing at age 4, and others may not be ready until age 6 (Lamme, 1979; Laszlo and Bairstow, 1984). When evaluating the actual task of children's handwriting, there are three elements that warrant attention:

1. Biomechanical and ergonomic factors, for example, sitting posture, pencil grip, and writing tools and papers
2. Quality of writing, for example, levelling, directionality and spacing in letter formation
3. Observations/other considerations, for example, associated reactions and behavioural responses.

One of the most neglected classroom prerequisites for efficient handwriting is assuming and maintaining a balanced sitting posture (Benbow et al, 1992). Alston and Taylor (1987) identified significant contributions to handwriting illegibility by analysing 100 handwriting samples of 7- and 8-year-old children in England. In letter formation, they found that the most common characteristics included: (a) incorrect letter forms; (b) inadequate 'leading in' and 'leading out' of letters; (c) poor rounding of letters; (d) incomplete letter closure; and (e) inadequate letter ascenders and descenders.

There are also many research studies investigating the development and effect of different pencil grips on a child's handwriting performance. Schneck and Henderson (1990) analysed the developmental progress of pencil grip and found that about one-quarter of children aged 5 years 0 month to 6 years 11 months adopted the lateral tripod grip. Recent studies have found that adults and children with good handwriting skills use a wide variety of pencil grip patterns and that an atypical grasp pattern by itself does not necessarily result in handwriting difficulties (Ziviani and Elkins, 1984; Ziviani, 1987; Schneck and Henderson, 1990; Schneck, 1991).

Occupational therapists should consider all three elements in order to access a child's functional performance of handwriting in either manuscript (print) or cursive (joined script), or both. It is important to assist the educational team and parents in identifying the child's problematic areas of handwriting as well as to establish the child's baseline of handwriting function.

Performance contexts

Performance contexts (AOTA, 1994) are situations or factors that influence an individual's engagement in desired and/or required performance areas. There are two aspects of performance contexts:

1. Temporal aspects, for example, chronological, developmental, life cycle and disability status
2. Environmental aspects, for example, physical, social, cultural and spiritual.

The conceptual model

There is an interactive relationship among performance areas, performance components and performance contexts. Function in performance areas within a specific set of performance contexts is the ultimate concern of occupational therapy. Identified deficits in performance components should be considered as they relate to participation in different performance areas. For example, a child's difficulty in handwriting (that is, performance areas) could be related to poor visual form perception and poor visual-motor skills (that is, performance components). Treatment should be directed at remediating these underlying dysfunctions with consideration of the child's age, health status and other environmental factors (that is, performance contexts).

The interaction between the performance components and functional performance in handwriting is expressed through the Conceptual Model for Performance in Handwriting, as illustrated in Fig. 1. A conceptual model is an organising technique designed to assist in categorising ideas and structuring approaches to thinking about complex problems (Hurff, 1985). It helps occupational therapists to be clear about what they are doing and why, so that they can identify their unique role and set a professional boundary (Creek and Feaver, 1993). It emphasises the concept of thinking like an occupational therapist (Hansen and Atchison, 1993).

Fig. 1. Conceptual Model for Performance in Handwriting.

Deficits in the following performance components*	→	**will affect a child's functional performance in handwriting**
■ Sensory, perceptual, praxis and motor functions		■ Biomechanical and ergonomic factors
■ Cognitive functions		■ Quality of writing
■ Psychosocial functions		■ Emotional and behavioural responses

*Based on AOTA (1994).

Evaluation of handwriting skills

Evaluation is defined as the planned process of obtaining and interpreting the objective/subjective and quantitative/qualitative data necessary for treatment. Occupational therapy evalu-

ation involves examining performance areas, performance components and performance contexts. Accurate and relevant assessment data are required to set specific goals and objectives in programme planning. It also provides a baseline to monitor the child's handwriting progress.

Assessment procedures

When a child with poor handwriting performance has been referred to occupational therapy, the methods of gathering objective and subjective information must be carefully selected and sequenced. A comprehensive evaluation of a child's handwriting function includes the following assessment procedures (Amundson and Weil, 1996): (a) examining written work samples; (b) discussing the child's performance with the teacher, parents, and other team members; (c) reviewing the child's educational/clinical record; (d) directly observing the child when he or she is writing in the natural setting; (e) evaluating the child's functional performance of handwriting, that is, biomechanical/ergonomic factors, and quality of writing; and (f) assessing any suspected interfering performance components related to handwriting, that is, sensorimotor, cognitive and psychosocial factors.

Handwriting evaluation tools

Formal or standardised tests are critical in the assessment of children because they provide objective measures and quantitative scores, aid in monitoring a child's progress, assist professionals to communicate more clearly and advance the field through research (Campbell, 1989). A number of formal or standardised handwriting evaluation tools have been developed by different occupational therapists and psychological and educational professionals (see Table 2). Most of these tools have been developed in North America, with the use of writing styles different from those used in the United Kingdom.

Table 2. Handwriting evaluation tools

Type	Tools
Criterion-referenced	■ Denver Handwriting Analysis (Anderson, 1983)
	■ Diagnosis and Remediation of Handwriting Problems (Stott et al, 1985)
	■ The Handwriting File (Alston and Taylor, 1988)
	■ Evaluation Tool of Children's Handwriting – ETCH (Amundson, 1996)
Norm-referenced	■ Children's Handwriting Evaluation Scale – CHES (Phelps et al, 1984)
	■ Children's Handwriting Evaluation Scale for Manuscript Writing – CHES-M (Phelps and Stempl, 1987)
	■ Minnesota Handwriting Test – Research Version (Reisman, 1987, 1991)
	■ Test of Legible Handwriting (Larsen and Hammill, 1989)

For tool selection, the occupational therapist should keep in mind the characteristics of each instrument as well as the strengths and limitations of the tests regarding normative data, reliability and validity, and other psychometric properties. It is important to go beyond standardised tests to gather qualitative information and to observe how the deficits in performance components will affect a child's functional performance in handwriting.

A handwriting profile (see Table 3) has been developed for clinical practice (Chu, 1997). It summarises qualitatively the child's level of function in different areas of performance components and functional performance of handwriting skill.

Table 3. Handwriting profile

Performance components	Functional performance
A. SENSORIMOTOR COMPONENTS	**A. BIOMECHANICAL AND ERGONOMIC FACTORS**
1. Sensory processing functions – Registration, modulation, discrimination – Tactile, proprioceptive, vestibular	1. Furniture – size, height
2. Perceptual processing functions (a) Body perception (b) Tactile perception (c) Kinaesthetic perception (d) Vision (e) Visual perception (f) Left/right orientation (g) Auditory perception	2. Body posture – Upright posture, trunk position – Head position, leg position
3. Postural-motor control (a) Muscle tone (b) Reflex integration (c) Postural control – Prone extension – Supine flexion – Midline/central stability (d) Shoulder – Stability – Mobility (e) Dynamic forearm rotation (f) Wrist – Stability – Mobility (g) Hand muscle strength (h) Hand arches (i) Thumb stability (j) Fine motor control – Isolation of movements – Grading of movements – Timing of movements (k) In-hand manipulation – Finger to palm – Palm to finger – Within finger (l) Isolation of arm movements (m) Precise interplay between opposing muscle groups (n) Bilateral integration – Laterality – Crossing body midline – Hand dominance – Bilateral motor co-ordination (o) Ocular-motor control (p) Visually-directed hand movements	3. Shoulder posture – Shoulder position, scapula position – Humerus position, right/left sides
4. Praxis (a) Central processes – Ideation – Motor planning – Execution (b) Sequencing (c) Spatial organisation (d) Graphic praxis (e) Constructional praxis (f) Auditory-motor integration	4. Forearm posture
B. COGNITIVE COMPONENTS 1. Attention 2. Memory 3. Language – comprehension 4. Reasoning	5. Hand and wrist posture – Wrist stability, wrist mobility – Hook wrist – Intrinsic muscles, transverse arches
C. PSYCHOSOCIAL COMPONENTS 1. Emotional stability 2. Self-esteem 3. Motivation 4. Self-control	6. Handedness
	7. Writing tools
	8. Pencil grip
	9. Tension of grip
	10. Type of paper
	11. Pressure on paper
	12. Bilateral integration – stabilisation of paper, crossing midline
	13. Paper position – initial position, adjustment
	14. Postural background movement – midline stability, compensatory movement
	B. QUALITY OF WRITING
	1. Basic writing patterns
	2. Writing style – printing, joined up, full cursive
	3. Letter/number formation – Directionality, spacing, slant – Levelling, size, curve formation – Letter closure, letter orientation – Joined up, ascenders/descenders – Distortions, collisions, ambiguous
	4. Sequencing of letters
	5. Phoneme – grapheme
	6. Writing speed and endurance – speed, endurance
	7. Upper/lower case
	8. General impression – legibility, consistency, neatness
	C. OTHER OBSERVATIONS/ CONSIDERATIONS For example, – Associated reactions – Associated movements – Squirms and fidgets – Vocalisation – Fatigue – Frustration – Resistance to task – Impulsiveness – Worried about mistakes – Constant erasures – Timid and nervous – Hesitation – Dislikes writing – Avoidance

Treatment planning

Occupational therapists may be instrumental in developing a handwriting remediation programme to be integrated into the child's educational plan. The following points should be considered in the whole treatment planning process.

Setting goals and objectives of treatment

Goals of treatment should be established in collaboration with the parents, teachers and, if possible, the child involved at the early stage of treatment planning. Specific objectives should be selected as an indicator of progress and improvement. The goals and objectives selected should be realistic, achievable, observable and measurable.

Treatment principles

Therapists should be sensitive to the child's needs because handwriting difficulties may cause frustration and anxiety. The therapist assists in this learning process by creating an environment that encourages a positive change in the child's behaviour (Todd, 1993). Teaching principles are used by the therapist to help a child process information in a meaningful way; for example, the therapist selects activities and creates an environment which reflect a child's aptitude; considers motivational factors; engages the child actively in the task; begins training at the child's current level of functioning and proceeds at a rate that is comfortable for him or her; and uses positive reinforcement and feedback (Mosey, 1986).

Collaboration between occupational therapist and teacher

Occupational therapy is process-orientated, while education is product-orientated. The teacher is primarily responsible for handwriting instruction; 'the therapist's role is to determine underlying postural, motor, sensory integrative, or perceptual deficits that might interfere with the development of legible handwriting' (Stephens and Pratt, 1989, p311). Both aspects of intervention are important. Collaboration should be established at the early stage of evaluation and intervention.

Service delivery models

Providing occupational therapy services to children with handwriting dysfunction should be based primarily on the needs of the individual child. Occupational therapy service delivery in mainstream schools has typically been implemented with three models: (a) direct therapy, (b) monitoring and (c) consultation (Dunn, 1991; Mosey, 1993). Therapists could use a continuum of service delivery models that allows for more flexibility, fluidity and responsiveness to an individual child's needs.

Therapists also need to consider other factors when helping a child with handwriting difficulties, such as the school policy on handwriting, the demands of the National Curriculum, the expectations of the parents, the teacher and the child, and the resources of the service.

Service provision approaches and treatment approaches

Occupational therapists adopt different service provision approaches to address the specific needs of a child with handwriting difficulties. An intervention programme is devised by integrating relevant techniques from different treatment approaches (see Table 4). The six service provision approaches (Mosey, 1993) which may be used concurrently and/or sequentially in intervention are as follows.

Remedial approaches

Remedial approaches emphasise facilitating the improvement of performance components, such as perceptual training. A child may have deficits in different aspects of the three performance components that affect his or her development of handwriting skills, such as sensory processing dysfunctions, perceptual processing dysfunctions, deficits in postural-motor control and praxis, specific cognitive dysfunctions and psychosocial disturbances.

It is impossible to cover the relevant treatment strategies for all aspects of the performance components in this article. It is important to note that (a) if a child has an underlying sensory integrative dysfunction which contributes to the child's presenting problem in handwriting skills, then sensory integrative therapy should be the first choice of remediation; and (b) if a child has specific deficits in the perceptual processing functions and/or perceptual-motor functions without an underlying sensory integrative dysfunction, then perceptual and/or perceptual-motor training will be appropriate as a remediation approach.

Functional approaches

Functional approaches emphasise facilitating mastery of tasks, such as manual writing skills training. Handwriting may be viewed as a complex sensorimotor skill and, like other acquisitional skills, can be improved through practice, repetition, feedback and reinforcement (Holm, 1986). Graham and Miller (1980) recommended that instructional guidance in handwriting be (a) taught directly; (b) implemented in brief daily lessons; (c) matched to individual needs of the child; (d) planned and changed based on evaluation and performance data; and (e) used in a meaningful manner by the child.

The instructional approaches of handwriting intervention methods vary but tend to include a combination of sequential techniques, such as modelling, tracing, copying, composing, stimulus fading and self-monitoring (Milone and Wasylyk, 1981; Bergman and McLaughlin, 1988). When therapists and educators employ these conditions in a positive, interesting and dynamic learning environment, children are more likely to become efficient, legible writers (Milone and Wasylyk, 1981; Barchers, 1994).

Compensatory approaches

Compensatory approaches emphasise minimising the effect of deficits in performance components in areas of functional performance, for example, the use of tape to indicate the proper positioning of paper on desk and the use of audio-tape.

Adaptive approaches

Adaptive approaches emphasise changing the task, or aspects of the environment, to minimise the effect of deficit in performance subcomponents and/or related behaviours on areas of occupational performance; for example, reducing the amount of copying task and putting the main points or headings on paper.

Management approaches

Management approaches emphasise minimising distressing or disruptive feelings and behaviour so that the individual is able to deal more directly with primary problems, such as psychological support and praise/reward. The results of different research studies indicate that relaxation training can help to improve handwriting performance by reducing muscle tension (Carter and Synolds, 1974; Jackson and Hughes, 1978; Hughes et al, 1979; Jackson et al, 1980).

Maintenance approaches

Maintenance approaches emphasise preserving and supporting an individual's current level of function, in a protected environment, such as the use of a voice-activated computer.

Table 4. Occupational therapy service provision approaches (Mosey, 1993) and treatment approaches for children with handwriting difficulties

Service provision approaches	Treatment approaches
Remedial	■ Sensory integrative therapy ■ Sensorimotor therapy ■ Neurodevelopmental treatment ■ Perceptual-motor programmes ■ Visual perceptual training ■ Fine-motor and visual-motor skill training ■ Pre-writing training (Klein, 1982)
Functional	■ Biomechanical and ergonomic interventions, such as sitting posture, pencil grip ■ Acquisitional (instructional) approach ■ Alphabet work ■ Multisensory techniques ■ Kinaesthetic writing (Benbow, 1990) ■ Mystery writing ■ Rainbow writing ■ Guided writing (Price, 1986) ■ Self-evaluation checklist
Compensatory	■ Use of audio-tape ■ Laptop computer/electric typewriter ■ Keyboard skill training ■ Someone to do the writing ■ Colour code to indicate orientation
Adaptive	■ Reduce the amount of copying task ■ Put main points or headings on paper ■ Adaptive devices or tools, such as pencil grip, Write Angle, special lined paper, adjustable furniture
Management	■ Motivational approach – intrinsic and extrinsic ■ Reinforcement programme, such as token economy, star chart, praise/reward ■ Relaxation training ■ Peer group support ■ Coping skill training
Maintenance	■ High power information technology appliances ■ Voice-activated computer

Evidence-based practice

In recent years, evidence-based health care and clinical effectiveness have become popular topics (Appleby et al, 1995). The National Health Service Executive and the Department of Health have made improving clinical effectiveness a key NHS priority for the last 3 years, and have invested heavily in fostering evidence-based practice (NHS Executive, 1996).

Davidoff et al (1995) described evidence-based practice as the processes in which health care professionals (a) make clinical decisions based on the best available scientific evidence, (b) seek and select evidence to meet a clinical problem rather than habits or protocols, (c) use epidemiological and biostatistical ways of thinking about evidence, (d) carry out critical appraisal of information, and (e) constantly evaluate their own performance.

A major part of the occupational therapy programme aims at remediating the child's underlying dysfunctions in different performance components. There are many research studies providing evidence to support this area of occupational therapy. For example, Furner (1967) emphasised the need for handwriting programmes with verbalisation and perceptual-process training. Strayer and Ames (1972) found that children's ability to copy designs improved after a brief period of visual-perceptual training that emphasised the orientation of figures. Jennings (1974) showed a positive and significant relationship between the ability to manipulate objects and the ability to copy designs. Laszlo and Bairstow (1983, 1984) found long-term benefits after using a kinaesthetic and sensitivity training programme with 7- and 8-year-old children. Stott et al (1987) recommended the development of a motor scheme which emphasised large movement patterns along with a smooth, fluid motion. Oliver (1990) demonstrated significant improvement in the writing readiness skills of a group of children aged 5 to 7 years after the use of a sensorimotor programme.

Conclusion

Handwriting is an important academic occupation for children. Children in mainstream education with specific developmental disorders are often referred to occupational therapy with the primary reason for referral being handwriting dysfunction. Occupational therapists possess the skills and expertise to make important contributions to interventions regarding handwriting dysfunction. An extensive neuromuscular and sensorimotor background, experience with functional training, knowledge about psychological and social behaviour, competence in analysing complex activities, and the capacity for making the most boring task enjoyable are all attributes that empower occupational therapists to evaluate and treat children with handwriting problems expertly (Cunningham, 1992).

The role of the occupational therapist in evaluating and treating a child's functional performance of handwriting skills is highlighted through a conceptual model of practice. It is emphasised that handwriting intervention programmes should be comprehensive, incorporating activities and therapeutic techniques from different remediation and functional approaches. Different adaptive, compensatory, management and maintenance strategies may also be employed to provide the child with a successful and efficient means of coping with demands in the natural setting.

It is also important to set clear criteria of referral, to develop valid and reliable screening and evaluation instruments, and to carry out scientific research to validate further the efficacy of occupational therapy for children with handwriting difficulties.

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