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JOURNAL OF THE ASSOCIATION OF PAEDIATRIC CHARTERED PHYSIOTHERAPISTS
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THE MANAGEMENT OF CHILDREN WITH CEREBRAL PALSY

EDITORIAL

LIN WAKLEY
Editor

The management of children with cerebral palsy, as you all know, is an enormous subject and it would be impossible to cover all aspects within one journal. I chose these articles to illustrate that you do not have to be a research physio to undertake a research project or small study and then submit it for publication in the APCP journal. Half of the articles are written by ordinary paediatric physiotherapists. (I don't mean this to be demeaning).

Evidence based practice is what purchasers are now asking for. It can only enhance our position as paediatric physiotherapists if we can provide the evidence ourselves. Undertaking small research projects and studies within our place of work and publishing as much as possible must be the way forward.

I hope the articles I have included will stimulate further discussion and will inspire you to write articles in the future. There are a large number of references at the end of each article and these could be the starting place for further studies.

The way you could launch yourself into print is to start by writing a case study of a child you are treating or have treated in the past. September's journal is entitled **SYNDROMES** and the Editorial Board is looking for articles on rare and/or unusual syndromes. Can you help?

Copy for the JUNE 1999 Journal
must be with the editor by
1st MAY 1999

The board reserves the right to edit material submitted

Sue Booth (Senior Paediatric Physiotherapist)
Wigan and Leigh Health Services NHS Trust

Dear Lin,

I am writing in response to the letter from Jo Whittaker regarding arrangements for therapy during literacy hours.

This issue is a difficult one for two reasons, firstly it is a daily event and secondly it involves whole class teaching. This means you cannot visit the child on another day at the same time, nor can you withdraw them, nor can you realistically treat them within the class as its impossible to avoid disrupting the rest of their peers.

Therefore we have adopted a number of partial solutions and some suggestions, but it is a debatable question if they will still be as effective when the daily literacy hour becomes a two hour literacy and numeracy event.

1. Use some of the time to do administration and paperwork.
2. Adopt mixed caseloads of juniors and seniors within schools and see your seniors at these times.
3. Negotiate with your head to see if children can be withdrawn on a limited basis, this is worth a try even if doubtful.
4. Use the time as one where you concentrate on the child's positioning, primarily standing regimes, so that they access their literacy/numeracy hours more effectively and so you will then see them for therapy outside of their standing frame times.

It is quite obvious that in introducing these initiatives, the government has given no thought at all as to how they might impact on the delivery of statemented needs. At least with the National Curriculum there was a provision made for appropriately differentiating it to meet the individual child's special needs; this new initiative seems to make no such allowance, as if all children are alike and taking no account of their additional needs. As therapists we can't afford to lose two hours of access daily at a stroke, and expect to maintain our service to these children, I would therefore suggest that this is a definite case for the A.P.C.P. to take further.

Yours sincerely,

Sue Booth
(Senior Paediatric Physiotherapist)

LETTERS TO THE EDITOR

Caroline Coleman MCSP
Naomi House
Stockbridge Road
Sutton Scotney
Winchester SO21 3JE
Telephone: 01962 762532
Facsimile: 01962 760090

Dear Editor

I was wondering if you could help me?

Recently one of our nurses has been compiling a set of guidelines regarding the use of suction for children with a tracheostomy. We have a child staying with us on a regular basis in this situation and it is quite likely that we will encounter it again in the future.

She has obtained the latest RCN guidelines and has asked me to provide her with those from the CSP. Since we are specifically oriented towards children here I thought that I would contact you first to ask if the APCP had issued any guidelines on this subject that you are aware of, or indeed if you are aware of anything suitable published by the CSP?

Thank you very much for your help.

Caroline Coleman MCSP

Jacqui Taylor/Alison Hacking
Senior Physiotherapists
(Neurology)
Great Ormond Street Hospital

Dear Colleagues,

We are writing to request help from any of you who have experience in Hydrotherapy with ventilated patients.

We work in a unit for children who are long-term ventilated (all via tracheostomy) and would very much like to give these hospitalised children experience of the water.

Any ideas, experiences, protocols or references with regard to Hydrotherapy for tracheostomy and/or ventilated patients would be of enormous benefit.

Please contact: Jacqui Taylor or Alison Hacking
Physiotherapy Department
Great Ormond Street Hospital
Great Ormond Street
London
WC1N 3JH
Telephone No: 0171 405 9200 Bleep 463
E-mail address: jason@jacquitaylor.freeserve.co.uk

Many thanks in anticipation of any response.

Jacqui Taylor/Alison Hacking
Senior Physiotherapists (Neurology)

LETTERS TO THE EDITOR

Kerry Warin
Senior Paediatric Physiotherapist
South Tees Community & Mental Health NHS Trust
The Cleveland Assessment Unit
Middlesbrough General Hospital
Ayresome Green Lane
Middlesbrough
Cleveland
TS5 5AZ
Tel: 01642 850850 ext. 5573

Dear Lin,

I am currently involved in the treatment of a two year old boy with mixed spastic athetoid quadriplegia.

He presents with a strong pull into shoulder external rotation and extension with shoulder girdle reaction and over the last month one shoulder has shown recurrent dislocation.

If anyone has any suggestions, they would be gratefully received.

Yours sincerely,

Kerry Warin
Senior Paediatric Physiotherapist

Jane Field
Senior I Paediatric Physiotherapist
Barnsley Community & Priority Services NHS Trust
Paediatric Physiotherapy Department
Barnsley District & General Hospital,
Gawber Road,
Barnsley
S. Yorks S75 2EP

Dear Lin,

I am a physiotherapist working in a school for children with profound and multiple learning difficulties. In the not too distant future, our school is due to amalgamate with a school for children with similar problems and a school for children with physical disabilities, creating a so-called 'super school'.

Each school has existing therapy staff (Physiotherapists, Occupational Therapists & Speech & Language Therapists) whom we hope will be deployed into the new school.

I would be interested to hear from any therapist who works in such a mixed environment so that we can be prepared for whatever is coming our way.

Yours sincerely,

Jane Field
Senior I Paediatric Physiotherapist

Clarissa Cave, Sarah Rusbridge,
Ruth Simon.
Richard Cloudesley School,
Golden Lane,
London
EC1Y 0TJ

Dear Madam

We are working in a special school for children with physical disabilities. The age range of the school is from 2½ to 18 years. The children are diagnostically a mixed group but many are non or semi ambulant. We therefore need to assist the children in standing daily and do so by using standing frames.

We are finding it increasingly difficult to stand the children as regularly as we wish due to:

• health and safety issues surrounding the lifting and handling of children

- the numbers of children able to be stood at any time in one classroom
- storage of standing frames which are becoming larger and larger!

Secondly, we would be interested to hear from anyone who has pupils who stand while using headswitches to access their computers and if so what devices they are using.

Please contact us c/o Richard Cloudesley School, Golden Lane, London EC1Y 0TJ if you have any comments or solutions to the above problems.

Yours sincerely,

Clarissa Cave

Sue McKechnie
Superintendent Paediatric
Physiotherapist
Royal United Hospital
Combe Park,
Bath
BA1 3NG
Mary Dorrien Unit
Children's Centre

Dear Miss Wakley

We have recently become aware of the sticker on Posture Control Walkers supplied by Quest 88 Limited that states "Do not use on slopes". Also in the User Instructions issued with every walker it states "Do not use walker on any inclined surface or steps and stairs". On discussion with Quest 88 I am assured that this has been stated on every walker supplied by them.

As we know children use these walkers in schools, outside etc where there are slopes and ramps. I was concerned that if a physiotherapist assesses and supplies a Posture Walker knowing, for example, that the child will use it to walk up a ramp into their classroom on a daily basis and that child fell, the physiotherapist would be liable for injury to the child.

After consultation with our Health and Safety dept. we have now issued a disclaimer to all parents whose child has a Posture Walker stating that it may not be used on slopes and that the Trust cannot accept responsibility for any accidents resulting from failure of the equipment or when the walker is not used in accordance with the manufacturer's instructions or the instructions given by the physiotherapists.

In practice this means that a child has to have someone holding them when walking on a slope either with or without the walker. This is restricting the child's independence.

I discussed this at a meeting of paediatric superintendents in Wessex and S. West and they were all unaware of this supplier's disclaimer. We would like to bring it to the attention of all paediatric physiotherapists. Also, does anyone know of a suitable walking aid that can be used safely on a slope?

Yours sincerely,

Sue McKechnie

Superintendent Paediatric Physiotherapist

Following receipt of Sue Mckechnie's letter I contacted Quest 88 for their comment. The following letter is their response. Editor.

Grahame Jones
Design Director
Quest 88 Ltd
Aston Street
Shifnall
Shropshire

Dear Miss Wakley,

In response to Sue Mckechnie's letter to you, with regards the use of Posture Control Walkers, we would like to take this opportunity to emphasise the importance of product knowledge amongst physiotherapists and the children and carers they work with. When a piece of equipment is either loaned to, or bought for a user, we must ensure that the user and carer understands how the product should be set up for use, where the product is to be used, how to maintain and service it and how to recognise when it is no longer safe to use, either through damage or wear and tear.

At Quest 88 we go to considerable lengths to provide full User Instructions which detail the points made above. The disclaimers are not put in to protect ourselves from litigation but to set out the parameters within which the product is safe to use.

Before a product is launched on the market, we go through a process of design and development to ensure the product functions as intended and that it will, hopefully, benefit the user. Part of the design process is to consider everything that might go wrong with the product, or how it could be misused; Risk Analysis. In many cases, we will change the design to take into account the problems we have thought of. In other situations, where a change of design will make the product impractical, e.g. making the base so big it will not fit through a door, we notify the user, through User Instructions and warning labels, about the parameters within which it is safe to use the product.

We strongly urge all our customers to read the User Instructions for our products and all other equipment which they use. Even if they have been using similar products for years, reading over the User Instructions can bring to light new techniques for setting up a product, or a maintenance check which could extend the product life, or divert a nasty accident.

It is also important to pass on the information in the Instructions to other people who could be supervising the use of the product. We suggest that physios keep a register of equipment in their departments, which includes information such as when the product was last serviced and checked for damage, whom it is loaned to and whether User Instructions were issued when it was loaned out. This may seem like a burden but it will ensure that all products for which they are responsible are used correctly and are safe. This will also help the planning of resources, giving plenty of warning for a product to be replaced before it becomes unfit to use. We are sure purchasing authorities will respond favourably to requests for new products if they can see that unsafe equipment being replaced has been used correctly and regularly maintained.

We hope this letter highlights some of the aspects of product use we are concerned with as manufacturers. We are very encouraged that the debate on product use is opening up as issues of safety, product recycling and replacement are fundamental to the people we work with and the services we provide.

Yours sincerely,

Grahame Jones

Denise Nunn
Orthopaedic Case Manager
Great Ormond Street Hospital
for Children NHS Trust
and the Institute of Child Health
Great Ormond Street,
London WC1N 3JH

Dear Editor,

I would be very grateful if you would include the following information in the next APCP journal.

My name is Denise Nunn, and I have recently been appointed as the Orthopaedic case manager at Great Ormond Street Hospital.

It has been recognised that there have been problems for some time with planning of Orthopaedic surgery and sharing information with local teams, and this new post has been created with the aim of solving some of these problems.

I am myself a qualified Physiotherapist, previously working as a Senior I in Community Paediatrics, and therefore understand some of the issues that the local teams have to deal with.

I am keen for local therapists to contact me should they have any queries regarding a particular patient, or the department in general, and can be reached on 0171 405 9200 ext. 5480, or bleep 711.

Many thanks,

Yours sincerely,

Denise Nunn

Orthopaedic Care Manager

Dr Andrew Lloyd Evans,
MA, MD. FRCPCH
Consultant and Senior Lecturer in
Neurodevelopmental Paediatrics
The Bobath Centre for Children
with Cerebral Palsy
Bradbury House
250 East End Road
London
N2 8AU

Dear Lynne

When I saw my talk from the APCP Conference in your journal I noticed that the data on page ten has some errors in it. This is probably my fault in putting together talks too quickly! I did not have time to check the handout before allowing you to publish it. I enclose some replacement data which I should be grateful if you could publish to set right the mis-information.

Yours sincerely,

Dr Andrew Lloyd Evans, MA, MD, FRCPCH
Consultant & Senior Lecturer in Neurodevelopmental Paediatrics.

2.36/1000 live births:
1.38 term
0.98 preterm

Clinical picture (percentages for each group):

		Preterm			
	Overall	<28 weeks	28-31 weeks	32-36 weeks	Term
Spastic diplegia	45	80	66	58	29
Spastic hemiplegia	34	10	16	34	44
Spastic quadriplegia	9				
Dyskinetic	8				
Ataxic	4				

Andrea Mitchell
Sen. I Comm.
Paed. Physiotherapist
Paediatric Physiotherapist Service
Physiotherapy Department
Ashington Hospital
Ashington
Northumberland
NE63 0SA

Dear Lin,

As a group we have been looking at devising out-come measures for children with deteriorating conditions, eg Muscular Dystrophy, Leigh's Syndrome etc. We would be grateful to hear from anyone who has found any suitable out-come measures to use with these groups.

Yours sincerely

Andrea Mitchell
Sen. I Comm. Paed. Physiotherapist

A STUDY OF THE HIPS OF CHILDREN WITH BILATERAL CEREBRAL PALSY

DAVID SCRUTTON
Senior Lecturer in Physiotherapy and Bioengineering
The Institute of Child Health

Hip dysplasia often leading to dislocation is a well known secondary problem of children with cerebral palsy (CP). There have been reports of this affecting a few children with hemiplegia too, but it is reasonable to ignore it as it appears to be a very rare occurrence and in my experience presents only in 'hemiplegic' children who in fact have a markedly asymmetric diplegia. I have, however, seen a truly hemiplegic boy who was also profoundly developmentally delayed (and so did not walk) who developed a flexion-abduction hip deformity and dislocated his hip anteriorly; but that is a different, and I suggest, separate problem.

However, although the problem of hip dysplasia is well known, little has been written about its true incidence/prevalence as the many figures quoted over the years have been based on prevalence within a clinic/hospital population rather than within one which has been geographically defined. Without this information it is difficult to know whether it is worth setting up a surveillance protocol and what services need to be provided. Treating these hips requires orthopaedic supervision even when surgery is not required; and currently there are only a very few orthopaedic surgeons in this Country who have the necessary skill and experience. If the incidence were small this would not matter, but experience suggests that there is serious under-capacity and the children would benefit if there were a specialist clinic within every Health Region. In the meantime referral to those who fully understand the complexity of managing this disorder is delayed while the child is followed in a local orthopaedic clinic. Furthermore (and I have no evidence but my memory for this) when these children do finally reach a tertiary referral centre, those who present the least **treatment** problems are usually the ones who have had no previous surgery. In other words, these hips do better in the long run from being left alone surgically than having the wrong surgery. The problem has another aspect too. I meet physiotherapists who talk as though they equate referral to an orthopaedic surgeon as a 'failure' of their physical management and a wish to 'protect' children from surgery. I think they are wrong on both counts: physiotherapy is an essential component of the correct management of these hips but, for many, it is only a part; and experienced orthopaedic care is a partnership not a surrender of responsibility. Of course we all wish to protect the children from injudicious surgery, but that applies to injudicious anything!

However, there simply are not enough tertiary referral orthopaedic clinics for every child with bilateral CP to attend one. If we are to get these children to a suitable clinic we need to be able to select those most likely to run into trouble with their hips and to do this we need a surveillance procedure, but is hip dysplasia common enough to make routine surveillance worthwhile? If there are then:

how do we select the children?

when should we be looking?

what sort of motor disorders/children are at risk?

When I set up this study in 1990 these were some of the questions I was attempting to answer. Since I had worked for a number of years in the South East Thames Region and knew many of the paediatricians and physiotherapists, it seemed the natural population to choose, as I was going to need the willing cooperation of a large number of people simply to find the children, let alone attempt to follow them for several years. My first concern was that this population might not be representative of the Country as a whole, but on investigation it appeared that for all the factors likely to affect the population of CP the relevant health statistics were surprisingly similar (e.g. general fertility rate; stillbirth rate; percentage of live births in NHS hospitals; percentage of all births <2500 g.; and the mortality rates for the perinatal, neonatal, infant and early childhood periods). After writing the protocol, getting ethical permission and finding the funding, it then took three months of letter writing, travelling and discussions to set up a framework for notification of the children and their referral by their paediatrician; the agreement of the radiologists and radiotherapists in each Health District; discussion with the physiotherapists about a questionnaire; setting up an office to organize X-rays and data collection; and creating the databases to allow all this to happen in an orderly fashion and record the data collected. It may perhaps be of interest that it has required 88 (separate but automatically updated) databases to analyse the X-ray data alone; that is, without associating X-ray data with the type of CP, locomotor ability, severity etc. Many of these are now redundant, because they were set up to look for associations which are now accepted or rejected, but each was essential for a particular task.

The aim was to find all the children with bilateral CP born 1989 to 1992 inclusively; to assess them and get parental permission for them to join the study and have the X-rays; X-ray their hips (A/P pelvis to show hips) in a standardized position at 18, 24, 30, 48 and 60 months (corrected for gestational age); and to keep track of those that moved house, a record of their locomotor development, any surgery and some physical management data by six-monthly questionnaires sent to the physiotherapists. From these data to establish the current incidence of CP and their hip problems and to improve our understanding of the natural history of hip dysplasia.

I think this is possibly the place to say how this study simply could not have happened without the unstinting cooperation and patience of the physiotherapists. Throughout, their willing help has been astounding and I am profoundly grateful that they turned what could have been a mutual nightmare into a routinely pleasant social exchange of information.

The Children

I had asked for children with CP or profound developmental delay to be referred; the latter because some of them later turn out to have a hypotonic

CP. I also accepted referrals of children with hemiplegia as I wanted to select out the 'hemiplegic' children who actually had an asymmetric diplegia. Five hundred and forty-seven children were notified to the study of whom 485 were subsequently referred by their paediatrician (the remainder had some disorder other than CP). Of those, I have seen 481, rejecting 84 for not matching the study criteria (some did not have CP, or had moved into the Region since their birth etc.). Not all of the 401 children accepted into the study had CP; I was deliberately 'over-inclusive' so as not to miss a child. At entry 351 children had CP but by the age of five years changes of diagnosis reduced the figure to 346. The 1989 and 1990 birth cohort were revisited after age 5 years.

Although 12% had some involuntary movements less than 5% of the children had involuntary movement as their predominant motor sign. Sixty-six percent were predominantly hypertonic and over 90% had some hypertonia. About 40% were diplegic in distribution; over 50% had bulbar signs. Only 1% had structural scoliosis by age five years.

Just less than 60% could get to sitting (on the floor) and sit without propping by 5 years; and 39% could walk ten steps alone (with AFOs if needed).

Twenty three children had died before reaching age five years.

The X-rays

1587 X-rays were received, measured, photographed, recorded and reported. 1389 of these were for children who at age five years had a diagnosis of CP. Of these 1133 were at the study ages (I measured other hip X-rays which I found in the child's envelope), but 77 were after surgery and so could not be used as part of the natural history data. The results therefore are based on 1056 X-rays taken at the study five ages.

The X-ray position (which is a rather 'fussy' standard A/P position) has already been published (Scrutton & Baird, 1997), together with an explanation of the migration percentage and acetabular index. Measurement requires precision and cannot be done in the casual manner I have often seen if the figures are to mean anything worthwhile. For instance it has to be appreciated that, regardless of the possible inaccuracy of any measurement from an X-ray, the width of the lines drawn dictate the precision of measurement and crayon cannot allow any worthwhile measurement to be made however well it marks on the surface of an X-ray. I used a sharpened H6 pencil, but marked not the X-ray but superimposed tracing paper. Each X-ray was measured for migration percentages (Reimers, 1980), acetabular indices (Tonnis, 1976), Sharp's angles (Sharp, 1961), Smith's c/b and h/b (Smith *et al.*, 1968), the inter-foramina ratio (Tonnis, 1976) and femoral shaft angle, because ab-adduction affects the migration percentage (Reimers & Bialik, 1981).

Findings

I cannot publish these (they are part of an article and report in preparation) but I can list some of the conclusions which might be of immediate clinical use:

(These figures relate to children with bilateral CP)

1. The incidence of bilateral CP was around 1.77/1000 live births.

2. There was a preponderance of boys: M:F ratio of 1.45:1.

3. Twenty-eight percent of all hips had a problem* by age five years, involving 35% of all the children. This is an incidence of about 0.6/1000 of **all** *live births.* (The South East Thames Regional Health Authority had around 50,000 live births p.a.; so 0.6/1000 l.b. represents about 30 children p.a. or 540 under 18 years old.)

* A hip problem was defined as having had surgery, BTA injections or a HASO (prescribed by an orthopaedic surgeon) by age 5 years to increase or maintain hip stability.

4. If the children are to be seen by an orthopaedic surgeon before 4 years of age (the latest I think we should aim for) then X-ray can be delayed until 30 months. At this age the hip is showing rather more of the effects of the CP and less of the hip's inherent characteristics. *This delay (to 30 months) obviously does not apply to any child showing signs of a hip problem before that age.*

5. Risk is to a certain extent dependent on the severity of CP and to the age of walking, but not enough to use these as the sole selection criteria. So **all** these children should be X-rayed routinely at 30 months and someone needs to make it their job to measure and report the migration percentages.

6. Referral criteria are a local decision, but if children with a hip having a migration percentage greater than 14% are referred, about 95% of those who will have a problem (by age five years) will be selected. This will have a high false positive rate which can be reduced somewhat by not referring any child who has walked independently (10 steps alone, using AFOs if necessary) by thirty months. However the false positives are themselves a little 'false' as a number of the referred children will need regular orthopaedic review of their hip state, even though it may turn out that they do not need treatment.

Although it is generally recognized that if an acetabulum is to 'mate' well with its femoral head, the head should be well centred in the socket by around age 4 to 5 years (Harris *et al.*, 1975; Bleck, 1987), there is less evidence that early treatment is more effective than later treatment. The policy of referring early is based partly on a belief that prevention (of dislocation) is better than reconstruction (which is not universally agreed),

but also that orthopaedic surgeons are the professional group best able to treat this disorder and deserve the opportunity to make their decisions in their own time rather than be faced by the *fait accompli* late referral so often presents them.

Conclusion

I hope this short explanation of this hip study will make physiotherapists even more aware than they already are of the need for hip problems to be sought out actively, rather than being something one deals with when the problem arises. In CP there are not many things we can change radically in our patients' lives, but we do have the possibility of preventing early hip dysplasia from becoming hip dislocation, which can destroy their posture, limit their movement ability and put them at risk of pain and spinal deformity.

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Author: David Scrutton

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Tel/Fax: 01732 451934

David Scrutton is an Honorary Senior Lecturer at The Institute of Child Health and also at Guy's, King's and St. Thomas' School of Medicine. After qualifying in 1960 he worked for several years at Queen Mary's Hospital for Children, Carshalton before moving to The Newcomen Centre at Guy's Hospital in 1966. He was appointed Senior Lecturer in Physiotherapy & Bioengineering at The Institute of Child Health in 1993. The core of his work has been with families and their children, particularly those with cerebral palsy, and he has a long-standing interest in developmental deformity and orthotics.

THE CHAILEY APPROACH TO POSTURAL MANAGEMENT

Teresa E Pountney MA MCSP, Research Physiotherapist

Elizabeth Green MD BA Hons DCH, Consultant in Paediatrics Rehabilitation & Neurodevelopmental Paediatrics

Catharine Mulcahy BScOT, Dip COT, Dip Couns., Research Occupational Therapist

Roy Nelham BEng CEng MIMechE FIPEM FISPO, Consultant Clinical Engineer

The control of deformity in children with cerebral palsy has been a long standing problem for children, their families and clinicians. Hip and spinal deformities are extremely debilitating in terms of pain, limiting function and care. Interventions to prevent and treat these deformities have included soft tissue and bony surgery, postural management and more recently Botulinum Toxin treatment.

The natural history of cerebral palsy and the development of deformity has been well documented (Cornell 1997, Gudjonsdottir 1997). Most authors would agree that deformity develops due to the persistence of asymmetrical postures caused by abnormal muscle tone. There is currently a large base of knowledge on the adaptions which can happen to the musculoskeletal system and the theory of motor development which suggest that conservative interventions such as postural management interventions should be effective in promoting physical ability, function and reducing deformity.

At Chailey Heritage over the past 15 years a twenty four hour approach to postural management has been developed. The Chailey Postural Management Programme includes positioning and treatment in lying, sitting and standing and is designed to improve a child's functional ability, promote the development of normal movement patterns and reduce the progression of deformity. Positioning equipment complements therapy treatment regimes by continuing correct biomechanical feedback during the day and night.

This paper will explore the approach developed at Chailey Heritage in the light of the current knowledge of developmental biomechanics, musculoskeletal adaptations and motor theory and discuss the benefits of early postural management intervention.

Developmental Biomechanics

The term developmental biomechanics has been used to describe the forces affecting the growing skeleton (Le Veau & Bernhardt 1984) more recently the term has been used to describe areas of loadbearing and the positions of the major girdles and joints in the Chailey Levels of Ability. The Chailey Levels of Ability are an assessment measure of lying, sitting and standing ability which form the basis for prescription of the postural management programme. They were developed in response to a clinical need for an assessment method which clearly identifies elements of achievement for children at low levels of ability and forms a basis for prescription of postural management programmes including treatment and equipment (see following article) (Green 1995, Pountney 1990). The Chailey Levels of Ability use the following components to indicate a child's level of ability which include:

- Areas of loadbearing

- Position of the pelvis, shoulder girdle, trunk, head, limbs
- Symmetry of position and whether this was voluntary or involuntary
- Ability to move within position
- Ability to move into and out of position
- Support required to maintain the position
- Fine motor movements.

The biomechanical descriptions of loadbearing and position of the pelvis, trunk and shoulder girdle provide vital information as to how a child should be supported to experience a higher level of ability. Concomitant change is seen in motor ability and postural biomechanics. Other scales developed for use with children with cerebral palsy measure progress in terms of function alone and do not provide adequate information for the prescription of treatment and equipment as part of a postural management programme. Their use for children with severe impairment is also limited. The Chailey Levels of Ability enable small changes in a child's development to be charted where previously this was not possible.

Reliability & validity has been established for The Chailey Levels of Ability which are specified for use with individuals with motor impairment as an evaluative measure for motor ability and a prescriptive measure for the provision of postural management programmes (Pountney *et al* in press Physiotherapy).

Musculoskeletal Adaptations

Muscle and bone are both highly plastic tissues which adapt according to how they are used. Abnormal movement and function will result in length adaptations in muscles and abnormal bony development. Muscle shortening and apparently increasing spasticity is a common secondary problem for children with motor impairment. It can cause pain, make management and handling difficult and affect how much progress is made. Recent findings (Carr & Shepherd 1995, Dietz & Berger 1995, Lin *et al* 1994) suggest that many of the problems arising from neurological conditions are related to the adaptation of muscle to abnormal and restricted movement. Spasticity of cerebral origin generally develops slowly although some high brain stem lesions may have fast developing spasticity (Chapman & Wiesendanger 1982). This slow development of spasticity may indicate that there is a muscle adaptation to the lesion. Several researchers (Neilson & McCaughey 1982, Burke 1988) have suggested that a vicious cycle can occur with spasticity leading to muscle contractures which in turn lead to further spasticity. This occurs because the point at which the stretch reflex is activated is controlled by the length of the muscle. Consequently shortening may cause the stretch reflex to be activated earlier in the range of movement starting the cycle of spasticity

described. In muscles with high tone the sensitivity of the stretch reflex is increased and the child is unable to adequately control the reflex causing the muscle to contract. This situation is further compounded by a lengthening and consequent weakening of the opposing muscle groups. A classic example of this is the child who develops a crouch gait due to hamstring contractures and loses the power to extend the knees. At a structural level these changes occur due to addition or removal of sarcomeres within the muscles due to lengthening or shortening.

This link between muscle shortening and spasticity emphasises the importance of preventing muscle imbalance occurring. Carr & Shepherd (1995) report that the prevention of soft tissue contracture results in decreased spasticity. If changes in muscle length are causing stiffness then intervention must aim to alter muscle length. It is possible to confuse length related changes with spasticity and consequently not provide appropriate treatment. This is particularly true in the early stages of muscle shortening where no contractures are present. Muscle shortening is an insidious process and begins very early in life before clinically apparent. Consequently proactive treatment must start as soon as motor impairment is diagnosed to reduce stiffness and prevent muscle shortening.

At birth infants have predominantly Type II or fast twitch muscle fibres but as they progress through their motor skills and achieve an upright posture these change to Type I, slow twitch fibres. Children with neurological impairment do not progress through their motor skills rapidly and so often remain in certain stages of development for long periods. They do not experience the variety of movement which allows muscle to be used normally so the development of slow twitch fibres does not happen to the same extent. The predominance of fast twitch fibres predisposes them to increasing tone.

Tardieu *et al* (1988) and Lespargot et al (1994) have indicated that muscles require periods of stretch on a daily basis to maintain and/or increase muscle length. Periods of between five and seven hours have been cited in these studies. Work at Chailey Heritage with periods of stretch of at least 6 hours a day have been effective in altering muscles length.

Positioning needs to be in a neutral, symmetrical position to prevent the development of muscle length imbalances. These effects are crucial to the reduction of spasticity and consequent deformity. Equipment providing biomechanically appropriate support in a variety of positions can provide these periods of stretch whilst allowing the child to participate in normal daily life.

There are several factors which will affect the development of musculoskeletal adaptations which require consideration in the provision of postural management programmes. The following can be precursors of changes in muscle length:

- Immobility
- Disuse
- Asymmetry
- Abnormal Movement Patterns
- Growth

There are a number of ways that therapy interventions are used to promote motor development and reduce the risk of muscle adaptations. Treatment interventions can be categorised as loading or unloading muscle groups. Lin & Brown (1994) suggest that physical loading of muscles such as stretches and exercise produce slow twitch characteristics whereas physical unloading such as tenotomies and immobilisation may produce fast twitch characteristics. Fast twitch characteristics are known to contribute to spasticity.

Active exercise, passive movements and stretching will all load the muscle and increase blood flow, oxygenation and maintenance of joint range. Loadbearing with movement contributes to bone and joint development. Stretching and passive movements may be effective on warming up muscle and preventing connective tissue contractures. Short periods of stretch will not be adequate to increase muscle length.

Bone is also a plastic tissue and grows and responds to the forces placed upon it by muscle, weightbearing or other external forces such as gravity.

Formation of joints are affected by abnormal muscle forces and the development of hip dysplasia in children with cerebral palsy is an example of this. As long ago as 1896 a German orthopaedic surgeon Julius Woolf was advocating correcting deformity by conservative methods of changing forces. Postural management equipment which promotes the experience of normal forces by preventing muscle length changes and enabling weightbearing should be effective in reducing these bony adaptations. Chronological age, therefore, and not developmental age should be used as the indicator for the introduction of the sitting and standing position to reproduce the correct forces on bones at the appropriate age (Stuberg 1992).

The plasticity of the musculoskeletal system continues throughout life so it is possible to effect changes even in older children and adults.

Theories of Motor Development

Over the past two decades there has been a move away from the traditional model of motor development based on the neuromaturational theory towards a dynamic systems theory of motor control. The dynamic systems theory has arisen from the field of developmental psychology and provides the explanation for motor development which incorporates all the influences on a child which may affect their progress. (Piper & Darrah

1994, Bradley 1994). An example of how this works when acquiring early motor skills is when an infant is learning to forearm prop in prone. His nervous system needs to have reached an appropriate level of maturation. He needs to be on a comfortable supportive surface, to be awake and motivated and requires sufficient muscle strength and biomechanical competence with an external stimulus to lift his head. With one of these essential elements missing the child would be unable to achieve the task.

The dynamic systems theory concludes that motor development is not the result purely of a maturational process but is dependent on a whole series of factors that will alter the final outcome. The study by Green *et al* (1995) of early motor development showed that all the elements combined to enable the child to reach a higher level of ability and were essential to that achievement. Clinicians have believed for a long time that intervention for children with cerebral palsy can have an effect on their development and the dynamic systems theory supports this approach. Changing one element of the system e.g. the biomechanical support and feedback can have a significant effect on a child's functional ability. Previously popular theories state that maturation was the only influence on development and therefore do not provide theoretical support for therapy regimes (Piper & Darrah 1994).

During the studies at Chailey Heritage two major factors in the provision of positioning equipment were found to have an impact on a child's motor ability. The first was the surface on which the child was supported. Children at lying ability level 4 and below responded to hard surfaces with a reduction in their level of ability in comparison to when they were placed on a more compliant surface. (Green *et al* (1995).

The orientation of the equipment in space also had a profound effect on performance. Studies at Chailey Heritage and elsewhere have been shown to have an effect on physical and cognitive skills (Green 1987, Mulcahy *et al* 1988, Nwaobi *et al* 1983 & Nwaobi 1986, 1987, Savelsbergh & Kemp 1994). Reclined and tilted postures have resulted in:

- increased in back extensor muscle activity
- changes in ability to reach
- changes in hand position
- decreased oral skills
- visual disturbance
- reduced cognitive abilities

The Chailey Levels of Ability describe a sequence of normal motor development and clearly identify the biomechanical and motor skills that are required to achieve each level of ability. A variety of other factors

both physical and emotional have an effect on a child's motor performance such as the supporting surface; the infant's readiness to participate; the tasks presented as well as the infant's maturational level of ability.

The support systems

Prior to the development of the Chailey Postural Support Systems comfort and function had been the main guiding factors in prescribing postural support. Provision had been ad hoc matching equipment to symptoms with little reference to standardised assessment or prescription procedures based on improving motor ability.

The postural management equipment used in the 24 hour approach is designed to promote feedback of biomechanical forces present in higher levels of ability where movement occurs from a symmetrical base.

Developmentally appropriate positioning provides a stable base from which normal motor patterns can emerge. Poor basic positioning can lead to the development of abnormal compensatory movements for balance and lead to the promotion of abnormal motor patterns. Children should be allowed some controlled movement within the support to develop their motor skills. Reducing the degrees of freedom during skill acquisition has been a long recognised method of achieving motor skills (Turvey *et al* 1982, Vereijken 1992). Higher levels of function are possible within the equipment as a number of motor tasks requiring attention at any one time are reduced and concentration can be focused on specific motor or cognitive tasks.

Chailey Postural management equipment provides postural support in lying, sitting and standing as part of a twenty four hour programme and aims to promote normal movement; improve practical ability; reduce deformity; provide periods of muscle stretch; maintain a symmetrical position.

Promotion of Normal Movement

Abnormal movements are a contributing factor to the development of deformity. A habitual pattern of movement which happens in a limited range of movement prevents the regular full range of muscle stretch required to prevent deformity occurring. Abnormal patterns of movement may develop because a child's initial starting position for the movement is unstable. As movement begins abnormal postural compensatory mechanisms come into play to try and maintain a stable position. Windswept deformity at the hip progressing to scoliosis is a prime example of a deformity which may arise from such abnormal compensatory movements. Equipment provided at the correct level of ability can enable a child to move freely within and out from a stable base without fear of falling. The mechanism for maintaining stability is altered in children with cerebral palsy. The order of muscle activation is different, support to

aid stability has been shown to decrease these differences (Brogen *et al* 1996) and suggest that starting position and clinical conditions may have an impact on postural control.

Improving Practical Ability

Stability and feeling balanced is an essential prerequisite for developing physical and functional ability. A child who has difficulty maintaining sitting balance will have difficulty attending to other tasks. In order to achieve practical motor tasks this child first needs to be able to relax his constraints on degrees of freedom.

Equipment providing postural support for such a child therefore should enable him to maintain sitting or standing without human support. When the support provided is appropriate stability and sensory feedback will provide an experience of controlled posture. This enables fine motor skills and achievement in activities such as attending to task, eating, using switches to play with a toy, access a computer or drive a power chair.

Control of Deformity

The control of deformity will be achieved if the correct forces are applied to the child's musculoskeletal system to prevent the development of musculoskeletal adaptations. If measures are introduced early it may be possible to prevent the development of deformity rather than undo adaptations to the system. To prevent adaptations of muscle tissue it is necessary to maintain the joints over which the muscles act in a neutral starting position. This ensures that when a child returns to the resting posture they are correctly positioned. Equipment providing postural support and control offers the benefits of periods of stretch in a variety of positions which can be used to lengthen muscle and reduce spasticity.

Postural support that accommodates deformity will not be effective in arresting the progression of deformity.

Prescription of Treatment and Equipment

The Chailey Levels of Ability are also used to ensure the effectiveness of equipment provided for postural management. The child is assessed, ability determined, postural goals identified and appropriate postural management prescribed. Once a piece of equipment is provided for postural or practical support the child's ability is assessed using this equipment. For example a child who cannot maintain sitting independently and is seated in a correctly prescribed seat can be re-assessed in the seat for his ability to maintain his sitting position and to begin moving within his sitting base.

Current theories suggest that intermittent stretching combined with active exercise, passive movements, regular changes of position and a variety and repetition of interactions with the environment (Gordon & Forssberg 1997) are the most effective method of improving motor skills and practical

activity while preventing the progression of deformity. An effective posture management programme needs to include this combination of therapeutic control of active movement.

To be effective this programme needs to be useable allowing the child to participate in his normal activities with an improved level of ability. This programme should be designed with input from the child, parents, therapists and any other involved parties.

When based on therapeutic principles equipment will provide a developmentally appropriate position giving biomechanical feedback about the position and encouraging normal patterns of movement. It should enable the child to participate more actively in his environment by the use of powered mobility, computers and communication systems.

The Support Systems

For equipment to be used it needs to be user friendly and designed to ease handling and transport difficulties. The Chailey Support Systems have been extensively tested and refined prior to reaching commercial production.

An essential element of all the support systems is their adjustability. It is important particularly in the growing child that adjustments can be made for growth but also for changes in motor skills. These systems are designed to improve ability and so changes in pelvic position and loadbearing will occur and will need to be catered for. The equipment is adjustable to accommodate growth and changes in postural ability which is vital to ensure ongoing improvements in the child's ability.

Chailey Lying Supports

These provide a symmetrical position for sleeping or day time positioning in either the supine or prone position. They provide support that enables a child to achieve and experience a higher level of ability and also allows joints to rest in a neutral position.

Used as a sleeping position it will prevent the asymmetric lengthening and shortening that is the major cause of deformity by providing the long periods needed to prevent muscle adaptations occurring (Fearn *et al* 1992).

The supports promote retraction of the chin, protraction of the shoulder girdle, anterior tilt of the pelvis and loadbearing areas of at least level 4 lying ability. This position gives biomechanical feedback of a symmetrical positioning, provides a stable base for movement and maintains muscle and joints in a position for long periods to prevent and reduce the progression of deformity. The child can be placed in the support without daily adjustment of the support (see figure 1).

Fig. 1: Chailey Lying Support

Chailey Seating Supports

The CAPS 11 seating system provides the individual with a fully supported stable, sitting base with an appropriate level of support which maximises head, trunk and arm control. It will often improve a child's ability sufficiently to enable them to drive a powered chair.

The combination of carefully researched elements of the system include a ramped cushion, sacral pad, curved backrest, kneeblock, foot support and lateral trunk support. The seat must be adjusted correctly to the individual child's size, ability and practical needs by a trained user of the equipment. Regular review of the equipment is needed to accommodate changes in motor ability and growth.

The shape of the ramped cushion provides a flat base for the pelvis and the ramp maintains the femur in a horizontal position to reduce sliding. The curved backrest and sacral pad encourage shoulder girdle protraction and neutral to anterior pelvic tilt. A sacral rather than lumbar pad is employed as children at low levels of ability have not yet developed a lordosis and are thrown forward by a lumbar support. The kneeblock used together with the sacral pad and lateral supports positions the hips and pelvis in a symmetrical position and controls windsweeping of the hips whilst providing further stability for children of low levels of ability (Mulcahy *et al* 1988) (see figure 2).

This system is versatile enough to be used in different situations. It can be used in manual and powered chairs, on a specially designed mobile base, in the car, and can be secured on a dining or classroom chair, on the floor with footrests removed therefore only one functional seating system is needed for a variety of activities.

Chailey Standing Supports

These standing supports provide a developmentally appropriate standing position so that a child can experience a normal standing posture.

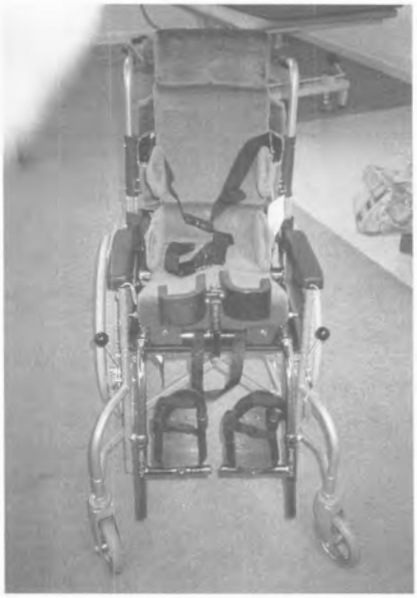

Fig. 2: CAP II Seating System

Experiencing a normal standing posture encourages improvement in ability, improves upper trunk and limb function and provides muscle stretch. They allow upper trunk movement and have a narrow chest pad and tray to facilitate hand function. It is simple to place the child in the system as only a pelvic and thoracic strap is needed and the support is easy to move with or without the child and the base of the stander is at floor level (Green *et al* 1993) (see figure 3).

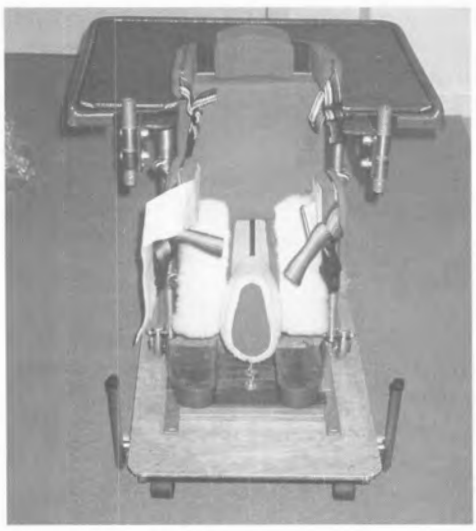

Fig. 3: Standing Support

Chailey Trike

This is a special adaptation to a tricycle which is based on a saddle seat with forward chest support and foot and hand restraints as required. The Trike enables children who cannot walk independently to have some form of independent self propulsion which is beneficial for maintaining cardiovascular fitness and take part in an activity with their peers on an equal basis.

Plan of twenty four hour postural management programme

A twenty four hour postural management programme is an approach to the handling, treatment and positioning of children that will promote their motor development and reduce the risk of deformity. It will enable them to participate in their normal daily activities whilst gaining the benefits of good positioning. Below is a plan of how a twenty four hour programme might be set up. The plan should be devised in collaboration with the child, their carers and their therapists. Below is an example of how a programme might be set up.

Lying Support	Nightly whilst asleep a minimum of 6 hours daily	Daytime use for rest or play
Functional Seating System	Daytime use at school & home	
Resting seating position	Evening/weekend use	
Standing Support	Daily use either home or school, minimum of 30 minutes	

ACTIVE EXERCISE

Active exercise is an important component of a postural management programme to help maintain muscle strength, joint range and cardiovascular fitness and allowing the child to experience some freedom of movement. Every child should have the opportunity to play and move on the floor free of equipment. Therapy programmes of exercise are essential to achieve specific areas of motor development.

Trike	Frequent use for fitness
Walker	Daily 30 minutes
Therapy	as prescribed
Free Time	Opportunity for floor play
Swimming	as available
Exercise programmes	as prescribed

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CHAILEY LEVELS OF ABILITY

To assess the child's level of ability place them in prone or supine on a firm, but not hard surface and encourage them to achieve their highest level of ability without assistance.

LEVEL	SUPINE	
1	Unable to maintain supine when placed except momentarily & very asymmetrically. Settles into sidelying - body follows head turning in a total body movement. Loadbearing through lateral aspect of head, trunk, upper arm & thigh. Neck extended with chin poked. Shoulder girdle retracted & pelvis posteriorly tilted. Arm movement random.	
2	Asymmetrical posture. Settles on back when placed. Loadbearing through head, shoulder girdle, trunk & posteriorly tilted pelvis. Chin poked. Shoulder girdle retracted, shoulders externally rotated & abducted, arms to side. Head to one side , pelvis & legs to opposite side. Head movement followed by pelvic movement in the opposite direction. Arm movement random.	
3	Maintains symmetrical posture. Loadbearing through head, shoulder girdle, pelvis & feet. Neutral pelvic tilt & shoulder girdle neutral giving general trunk curvature. Hips abducted & externally rotated. Chin tucked but not retracted & head able to turn freely from side to side. Controlled eye movements possible. Beginning of unilateral grasp to side of body, takes fist & objects to mouth.	
4	Symmetrical posture with loadbearing through anteriorly tilted pelvis & protracted shoulder girdle & upper trunk, with ability to change to head & trunk only. Able to retract chin. Definite lordotic curve. Shoulders able to flex & adduct allowing midline hand play above chest. Free pelvic movement beginning allowing child to touch knees with flexed hips or extend hips & knees. Feet to midline. Beginning of lateral weight shift, unilateral leg raise . Adept finger movements emerge during this level	
5	Loadbearing on shoulder girdle & pelvis or only on centre of trunk. Free movement of shoulder girdle & pelvis on trunk. Abl to retract chin. Pelvis has full range of movement, infants able to play with toes with hips flexed & knees extended & roll into sidelying. Can return to supine. Hand & foot play crossing midline. Adept finger movements	
6	Pelvis & shoulder girdle moving freely. Consistent ability to roll into prone by achieving sidelying as in level 5 & then anteriorly tilting pelvis on trunk & extending hips	

CHAILEY LEVELS OF ABILITY

To assess the child's level of ability place them in prone or supine on a firm, but not hard surface and encourage them to achieve their highest level of ability without assistance.

LEVEL	PRONE	
1	Asymmetrical top heavy posture with loadbearing through face, chest, shoulders, forearms & knees. Pelvis posteriorly tilted, hips & knees flexed. Head to one side with chin poked. Shoulder girdle retracted, shoulders flexed & adducted. Mouthing hand is possible in this position.	
2	Asymmetrical posture. Settles when placed. More generalised loadbearing through face, chest, upper abdomen, forearms knees & feet. Pelvis posteriorly tilted & shoulder girdle retracted. Shoulders flexed & adducted with elbows resting behind shoulders. Hand & arms to side, hips & knees slightly flexed. Head to one side with chin poked but beginning to lift it from floor with flat back profile & lateral pelvic movement	
3	Symmetrical position with load bearing through lower chest, abdomen, thigh, knees & forearms. Pelvis & shoulder girdle in neutral. Props on forearms with general trunk curve, head in line with spine & chin tucked. Uncontrolled lateral weight shift so may topple into supine	
4	Loadbearing through abdomen, thighs & feet, with either hand or forearm propping. Pelvis anteriorly tilted but not anchoring, shoulder girdle protracted. Angular lateral profile of upper chest & lower back. Able to retract chin with free head movement. Head & upper trunk movement can be dissociated from lower trunk allowing pivoting. Hand & foot play in midline.	
5	Loadbearing through iliac crests, thighs & lower abdomen with hand propping on extended elbows. Pelvis anteriorly, neutral or posteriorly tilted, shoulder girdle protracted. Angular profile between pelvis & lower back and upper trunk & head. Able to retract chin with free head movement. Pelvic anchoring enabling efficient pivoting & backward movement. Able to roll into supine	
6	Free movement of pelvis & shoulder girdle. Beginning to load bear on hands & knees. Rocking backwards & forwards in this position	

CHAILEY LEVELS OF ABILITY

To assess the level of sitting ability the child is placed in the sitting position on the floor if they are unable to achieve it independently.

LEVEL	FLOOR SITTING	
1	This level was originally described during work with children who had cerebral palsy. It was not observed in our study of normal infants. The child may not be able to be placed in a sitting position for a variety of reasons including a strong tendency to extend, extreme floppiness or fixed deformities.	
2	The child can be placed in a sitting position. Trunk weight can be brought forward over his sitting base. The pelvis is posteriorly tilted. The hips are abducted & externally rotated and loadbearing is through the buttocks & lateral aspect of the feet. The shoulder girdle is retracted or in neutral. The lateral profile is rounded.	
3	The child can be placed in a sitting position and can maintain it as long as s/he does not move. The pelvis is a neutral tilt with the hips abducted & externally rotated. Loadbearing is through the buttocks & lateral aspect of the legs & feet. The chin is tucked, the shoulder girdle is protracted & with the hands propping or otherwise aiding balance . Weight is forward over the sitting base.	
4	The child can be placed in a sitting position and is able to move his trunk forward & laterally within his base and return to upright. He can rotate his trunk within his base. The pelvis is anteriorly tilted, the hips are mainly abducted & externally rotated but can move to a more neutral position. The chin is retracted, the shoulder girdle is protracted and arms can move to shoulder level The lateral spinal profile is upright. Hands can be brought to midline & adept finger movements are possible.	
5	As level 4 but the child can tilt the pelvis anteriorly & posteriorly enabling balance with the trunk behind the base. This allows unilateral leg movement. The child can reach forwards out of his base & recover balance to either side. The hips are predominantly in the neutral position with loadbearing through the back of the thighs. Arms can move above shoulder height. Adept finger movements.	
6	As level 5 but the child can now move from the sitting position forward into prone. This is achieved by 'off loading' a buttock leaning forward & sideways in a controlled way	
7	As level 6 but the child can regain sitting from prone	

CHAILEY LEVELS OF ABILITY

The child's level of ability is assessed with them sitting on a flat box with the femur supported, the hips in a neutral position, the knees are flexed at 90°, feet flat on the floor the same width as the pelvis

LEVEL	BOX SITTING	
1	This level was originally described during work with children who had cerebral palsy. It was not observed in our study of normal infants. The child cannot be placed in the sitting position. The child may not be able to be placed in a sitting position for a variety of reasons including a strong tendency to extend, extreme floppiness or fixed deformities.	
2	Can be placed in a sitting position but needs holding to stay in position- at best can balance momentarily. Trunk weight can be brought forward over his sitting base. The pelvis is posteriorly tilted. The shoulder girdle is in neutral. The lateral profile is rounded.	
3	The child can be placed in a sitting position and can maintain it as long as s/he does not move. The pelvis is a neutral tilt The chin is tucked, the shoulder girdle is protracted & with the hands propping or otherwise aiding balance . Weight is forward over the sitting base.	
4	The child can be placed in a symmetrical sitting position and is able to move his trunk forward & laterally within his base both ways and return to upright. He can rotate his trunk within his base. The pelvis is anteriorly tilted. Able to retract chin. The shoulder girdle is protracted and arms can move to shoulder level. The lateral spinal profile is upright. Hands can be brought to midline & adept finger movements are possible.	
5	As level 4 but the child can tilt the pelvis anteriorly & posteriorly enabling the trunk weight to fall behind the base. This allows unilateral leg movement. Arms can move above shoulder height. Can use hands freely, and can recover balance after leaning to either side	
6	Can sit independently and can transfer weight outside of sitting base to leave the position	
7	Can move into the sitting position	

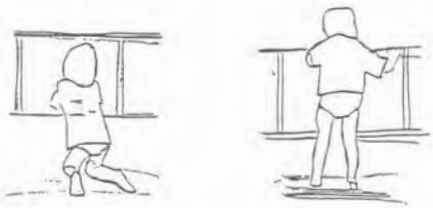
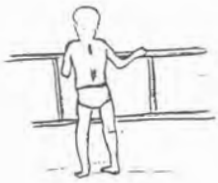
CHAILEY LEVELS OF ABILITY

To assess the level of standing ability the child is either held or placed in the standing position if unable to achieve standing independently.

LEVEL	STANDING	
1	Unable to maintain position independently. Needs to be fully supported under axillae. Minimal loadbearing through side or forefoot. Stepping reflex may be elicited. Unable to maintain head upright. Shoulder retracted and pelvis posteriorly tilted.	
2	Unable to maintain position independently. Needs to be held under axillae or held onto support. If using support ,loadbearing through trunk, forearms, hands and toes or plantargrade feet . Standing base smaller than or as wide as pelvis. Able to maintain head upright. Pelvis posteriorly tilted. Shoulder girdle protracted. May bend and straighten knees.	
3	When placed at support is able to maintain standing but not able to move. Loadbearing through trunk, forearms or hands and plantargrade feet. Standing base width of pelvis. Pelvis in neutral tilt. Uncontrolled load shift and leg movements. Flat back profile.	
4	When placed at support able to maintain position and move within base. Loadbearing through hands and plantargrade feet. Trunk upright and able to move away from support. Standing base as wide or wider than pelvis. Pelvis anteriorly tilted. Able to have one hand free for play. Single leg movements may occur.	

CHAILEY LEVELS OF ABILITY

To assess the level of standing ability the child is either held or placed in the standing position if unable to achieve standing independently.

5	Able to achieve standing using support usually through half kneeling. Able to move outside of base. Loadbearing through hands and plantargrade feet. Trunk upright. Able to lean backwards and rotate whole trunk. Free pelvic movement & lumbar lordosis. Can reach above shoulder height. Deliberate stepping within position. Leaves position in controlled way using support.	
6	Moving freely into and out of position using support. Cruising initially using three points of support with broad standing base progressing to two points with narrow base. Free pelvic movement & lumbar lordosis. Loadbearing through plantargrade feet, occasionally tiptoes. Decreasing amount of hand support which is mainly used for balance.	
7	Able to stand independently by releasing hands from support for a few seconds. Able to leave position without support. Standing base as wide or slightly wider than pelvis. Arms in medium to high guard position. Toe grasping.	
8	Assumes standing independently from quadruped or squatting position using hands.	

EFFECTS OF NEUROMUSCULAR ELECTRICAL STIMULATION CHILDREN WITH

A SERIES OF SINGLE-CASE SYSTEMS

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Background

Functional muscle contraction can be achieved using electrical stimulation without the need for an intact central or peripheral nervous system due to the development of action potentials on the muscle itself. Functional electrical stimulation (FES) used for many years in the treatment of spinal cord injury has also been used for drop foot prevention following hemiplegia (Bogataj *et al*, 1995). There has been a recent surge in interest about the potential use of Neuromuscular Electrical Stimulation (NMES) in the treatment of cerebral palsy.

In the child with cerebral palsy, the central control system is damaged, leading to secondary changes in the length and structure of the muscles and bones (Gage, 1991). Conventional physiotherapy can affect the central control system, through use of reflex inhibiting, spasticity reducing measures as in Bobath's (1970) neurodevelopmental approach. Although weakness of the affected muscles has been identified in children with cerebral palsy, resulting in diminished function (Olney *et al*., 1990), physiotherapists are reluctant to use traditional muscle strengthening techniques. This reluctance is probably due to three factors. Firstly, spastic muscles was considered to be already pathologically strong. Secondly, clinicians have assumed that intense voluntary muscle contractions would lead to increased spasticity and additional abnormal reactions (Bobath, 1970). Thirdly, spasticity has commonly been considered to be the primary cause of dysfunction. Therefore therapy has been directed at reducing the muscle tone in the expectation that movement will then be freed up. However some of these basic assumptions are now being questioned due to scientific and surgical advances.

Three types of skeletal muscle fibres can be distinguished; slow oxidative, fast oxidative and fast glycolytic. Fast glycolytic fibres (type II) generally have much larger diameters than oxidative fibres allowing them to develop greater maximum tension and, therefore, greater strength (Vander *et al*, 1994). Skeletal muscle is known to adapt to changes in activity level by altering both structure and function (Lieber, 1986). Because children with cerebral palsy are often less mobile than their peers it would be reasonable to assume that at least one adaptation would be atrophy of the muscle fibres. Following electromyographic studies, Berger *et al*. (1982) concluded that some of the abnormal gait patterns in cerebral palsy were related to changes of muscle properties. Support for this theory was provided by Dahlback and Norlin (1985) who found that children with cerebral palsy were becoming exhausted while working at levels of less than 50-60% of their maximal oxygen uptake. This suggested that their exhaustion was due to local muscle factors rather than cardiorespiratory insufficiency. These findings were further supported by Akataki *et al*.

(1996) who determined the electrical and mechanical properties of spastic muscle. Their findings suggested that motor disabilities in children with cerebral palsy are not only caused by primary neural impairment but also by secondary deterioration in muscle contractile properties, probably resulting from muscle fibre atrophy, more selectively in type II fibres. Previous histochemical analysis of spastic muscle by Rose *et al.* in 1994 confirmed that these children had a predominance of one type of fibre or another. Most commonly, it is the type II fibres which are lacking.

Hennemann's size principle states that the recruitment order within a motoneuron pool progresses from the smallest to the largest motoneuron (Hennemann *et al.* 1965). Therefore in volitional isometric contractions, smaller motoneurons, which innervate type I (slow) fibres are activated before larger motoneurons which innervate type II (fast) fibres. Delitto and Snyder-Mackler (1990) have theorised that NMES preferentially affects the type II muscle fibres that may not be fully activated during submaximal volitional contractions. Trimble and Enoka (1990) reinforced this theory in their study to determine whether the recruitment order of motor units elicited by NMES was different from that achieved with voluntary contractions. They concluded that direct activation of the motor axons by NMES did indeed produce a recruitment order of motor units that is different from the order used during voluntary exercise. So, it may be concluded that externally applied current, such as NMES, takes the path of least resistance and recruits more lower-resistance (larger diameter), type II fibres than higher resistance (smaller diameter) type I fibres. This would suggest that the strengthening of hypotrophic muscle may be more easily achieved using NMES than with voluntary exercise.

Recent years have seen an increase in the popularity of selective dorsal rhizotomy (Guiliani, 1991 & Dudgeon *et al.* 1994). Although this surgery successfully reduces spasticity, profound underlying muscle weakness is revealed. This suggests that treatments aimed at decreasing spasticity alone will not necessarily improve movement control. Greater emphasis should perhaps be placed on methods (e.g. active exercise or NMES) which will produce changes in the chemical composition of the muscle, leading to an increase in type II fibres (Vander *et al.* 1994).

In the treatment of stroke induced hemiplegia in adults, Bohannon (1986) has demonstrated that normalised muscle strength of the affected lower limb led to increased gait velocity, cadence and independence. In 1995 Damiano *et al.* showed that increasing the quadriceps strength in children with diplegic CP led to similar gait improvements. They also produced evidence to negate the assumption that other spastic muscles may become overactive as a direct result of muscle strengthening. This concern that NMES might increase spasticity was raised by Alfieri (1982), but in practice, this unwanted effect does not appear to occur (Carmick, 1994).

Hazlewood *et al*'s (1994) study was based on the rationale that stretch could be applied to the calf by stimulating the anterior tibial muscles to dorsiflex the ankle. Results included a significant increase in range of movement of dorsiflexion suggesting that NMES may be useful in the reduction of contractures when used in this way.

Some authors have postulated that electrical stimulation, even of very low intensity, may promote desirable trophic changes (Alfieri, 1982 and Pape, 1988 and Farragher, 1990). This is an important effect considering that spastic muscle is thought to grow markedly more slowly than bone growth, potentially resulting in contractures (Ziv *et al*. 1984).

It is the work of Carmick (1993a, 1993b, 1994, 1995 & 1997) that is of most interest to this proposed investigation. Through the detailed observation of several individual cases while using NMES as an adjunct to task specific physiotherapy, she has reported several interesting findings including improved foot posture, gait, balance, energy efficiency and strength. She emphasises that NMES should be used with task-orientated functional activities to enhance muscle contraction and provide sensation, thereby assisting motor control (1993a). She suggests that it is the lack of co-ordination and weakness of the triceps surae muscles that is the more significant problem in equinovarus gait rather than the lack of tibialis anterior strength. This suggestion can be re-enforced with gait analysis studies. If the ankle plantarflexors are not strong enough to restrain the forward momentum of the tibia, third rocker action of the ankle foot complex cannot occur which results in inadequate push off at terminal stance, with a resultant shorter stride length and inefficient movement (Perry, 1992 and Gage, 1991). During the stance phase of normal gait the soleus works eccentrically at loading response, and midstance. At terminal stance and pre-swing, both the soleus and the gastrocnemius work concentrically across the ankle to produce enough force for forward propulsion. In addition, the gastrocnemius works eccentrically across the knee during loading response (Gage, P85, 1991). Although NMES can only stimulate concentric contractions, Carmick (1995) attempts to explain why by electrically stimulating the calf muscles there may be an improvement in the child's eccentric muscle work, by drawing from the work of Lin and Brown (1992). The NMES may load the muscle, resulting in an increased number of contracting fibres, leading to increased muscle strength which will allow the child to use the muscle in a more mature manner, including eccentric work. In addition, Martin *et al*. (1993) showed that electrical stimulation allows the contractile qualities of muscle to be developed dynamically, including eccentrically. The gains obtained for the concentric muscle action were compatible with the assumption of the preferential recruitment of Type II fibres with NMES, including muscle hypertrophy. However, the gains obtained for the dynamic muscle actions are thought to be due to the training technique increasing the pool of motor units recruited and/or how often they discharge, i.e. nervous mechanisms.

The selected parameters of treatment were based on the recommendations of Carmick and are fundamentally consistent with other authors findings (Alfieri, 1982, Delitto and Snyder-Mackler, 1990, Trimble and Anoka, 1990, Martin *et al.* 1993, Hazlewood *et al.*, 1994).

To summarise, recent research suggests that the common practice of directing therapy at the reduction of spasticity to achieve normal movement may not be effective as the primary cause of movement disability may be the loss of muscle control and strength. Therefore emphasis should be redirected to train the child with cerebral palsy to gain strength and control of the muscles required for different tasks (Carr *et al.*, 1995).

NMES may be a useful means of achieving this as it produces immediate changes on the motor unit as well as by selective recruitment of type II fibres. However, empirical evidence is required if it is to be adopted into clinical practice.

METHOD

Design

The study was conducted using a pre-test, post-test single group design (quasi-experimental) because of the small available sample (n=8). The limitations of this type of study are recognised, particularly in relation to its lack of internal validity, but our aims at this stage of piloting were to identify trends and useful outcome measures in preparation for a later experimental trial. The experimental hypothesis states that the application of neuromuscular electrical stimulation to selected muscles of children with spastic cerebral palsy during task specific activities will lead to improvement in muscle strength and function. The sample was divided into two groups. Group 1 were ambulant and received NMES to their spastic posterior calf muscles. All of group 2 received NMES to their hip abductor muscles. All of the children who participated in the trial continued to receive conventional physiotherapy input at the same level as before and orthotic use was not altered except during application of the NMES when orthotics were removed. The independent variable for both groups was the NMES with parameters set as described in Table 1.

Table I: NMES Parameters of Treatment

	Group 1	*Group 2*
Wave Form	asymmetrical biphasic square	asymmetrical biphasic square
Pulse Rate	35Hz	35Hz
Pulse Width	300ms	300ms
Ramp	0.2s	0.8s
Active Electrode	med. head of gastroc.	gluteus medius
Inactive Electrode	lat. head of gastroc.	tensor fascia latae
Time	15 mins	15 mins

The dependent variables selected for Group 1 were: Dimensions D & E of the Gross Motor Function Measure (GMFM) (Russell *et al.* 1989), heel alignment in standing observed using photographs, ankle ROM using goniometry, calf bulk and calf strength (Lunsford & Perry, 1995).

The dependent variables selected for Group 2 were: Pediatric Evaluation of Disability Inventory (PEDI) (Haley *et al.*, 1993), active and passive hip ROM measured by manual goniometry and a photographic and video record.

Subjects

A sample of convenience of eight children was selected from within the Edinburgh area.

Group 1 consisted of four children.
The inclusion criteria for this group was:
- aged between 3 and 13 years
- ambulant without need of walking aids
- spastic diplegic or hemiplegic CP

Group 2 also consisted of four children.
Their inclusion criteria was:
- aged between 3 and 13 years
- spastic diplegic or quadriplegic CP
- hip adduction/internal rotation posture (static and/or dynamic)

The exclusion criteria was the same for both groups:
- moderate or severe cognitive impairment
- surgery related to CP in past year
- aversion to electrical stimulation
- severe, frequent epilepsy
- current inclusion in any other trial

Details of their age, sex and level of disability can be found in Table II. The children and their parents were informed of the implications of participation and written consent was obtained. Each child received two or three introductory sessions of NMES to ensure that it would be an acceptable form of treatment to them. In all cases the sensation of the stimulation was found to be acceptable and in some cases even enjoyable. The importance of slow, gently introduction to the modality cannot be overemphasised (Carmick, 1993a).

Table II: Participant Details

Participant	*Age*	*Sex*	*Disability*
1	13	M	Left hemiplegia
2	9	M	Spastic diplegia
3	12	M	Right hemiplegia
4	11	F	Right hemiplegia
5	9	F	Spastic diplegia
6	3	M	Spastic quadriplegia
7	10	F	Spastic quadriplegia
8	9	F	Spastic quadriplegia

Apparatus

Neuromuscular Electrical Stimulation (NMES) was applied using an 'Empi Respond Select' which is a dual channel stimulator which allows parameters of frequency, intensity, ramp, waveform and time to be selected as required. The unit can be attached to the participants' waistband and Neuroaid self-adhering re-usable electrodes were used. Electrode size was selected according to individual requirements to ensure that as many of the superficial fibres (and motor points) as possible were covered of the selected muscle, without overlapping adjacent muscle groups.

Procedure

All baseline measures were taken by the physiotherapist who was undertaking the intervention, inevitably introducing a level of bias. They were taken during the fortnight preceding the onset of intervention.

The period of intervention varied across the group from 17 to 20 sessions on a 15 minute, once a week basis. The level of current selected varied from week to week depending on participant tolerance. Where possible it was increased until a visible contraction occurred at the point of stimulation, but this level was occasionally not obtained due to low tolerance.

Group 1

Group 1 received NMES by means of a therapist activated remote switch attached by a 2m cable to the unit. Difficulties have been recognised with the use of remote switching methods due to the difficulty in correctly timing the delivery of the NMES (Hoffer *et al.*, 1996). Attempts were made to standardise this by using a fixed ramp and providing therapist training before the intervention period began.

The active electrode (cathode) was placed over the medial head of gastrocnemius and the inactive (anode) over the lateral head. Where possible it was activated at the moment of heel strike. However, as the participants received NMES while not wearing orthotics heel strike was not always attained, therefore the remote was switched at initial contact. The minimum ramp setting of 0.2s was selected in the expectation that the calf would be stimulated at the appropriate point of gait towards the end of 2nd rocker and throughout 3rd rocker of stance, when the calf would be expected to be working concentrically (Gage, 1991). The participants walked throughout the 15 minute period while receiving this remote controlled NMES.

Group 2

Three of Group 2 received the NMES with the machine set on a cycle of 5 seconds on, 10 seconds off for a period of 15 minutes. In each of these cases NMES was applied bilaterally with the active electrodes of gluteus medius and the inactive electrodes over the muscle bellies of tensor fascia

latae. Functional activities or postures were selected for use during the interventions, according to ability and altered as the study progressed. Active assisted hip abductions were progressed to weight shifting over the active leg in standing during the 20 week intervention period.

The other Group 2 member (participant 5) received remote switched NMES while walking or standing from the outset as she was sufficiently mobile to allow this. The active electrodes were placed over gluteus medius and the inactive electrodes over gluteus maximus. The selection of the inactive electrode placement differed from the others in the group due to the presence of scar tissue over the TFL. Remote switching was used by means of a thumb switch controlled by the therapist at mid-stance when the gluteus medius and other hip abductors should be active. Although the action of the hip abductors during mid-stance is eccentric, there is evidence to suggest that activating motor units during a concentric action can lead to improvement in eccentric control as previously discussed.

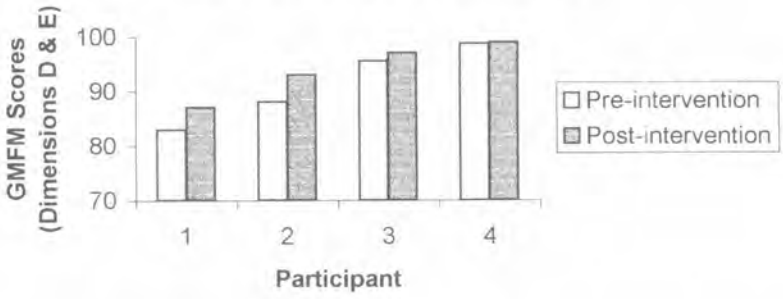
All baseline measurements were repeated before and after intervention. Selected measures were taken at the midway point and six weeks after completion of the pilot study.

Group 1 Results

1. **GMFM**

The GMFM scores were relatively high pre-intervention as the participants were all relatively high functioning. Nevertheless functional gains were made as can be seen in Figure 1.

Figure 1: GMFM changes with NMES



2. **Heel alignment**

Observed in standing and analysed visually with photographs. The photographs did not show conclusive evidence of improvement in heel alignment, unlike previous work of Carmick (1993a). However they do reinforce findings of increasing muscle bulk.

3. **Ankle ROM**

Little change in the range of ankle movement during the period of intervention was documented (Table III). This finding is significant because of the concern that any stimulation to the spastic muscle groups may lead to increased muscle tone and contracture development. However participant 3 had lost the ability to attain heel strike post-intervention.

Table III: Effects of NMES on ankle dorsiflexion

	Active ROM		*Passive ROM*	
Participant	*Pre-intervention*	*Post-intervention*	*Pre-intervention*	*Post-intervention*
1	75°	75°	85°	85°
2(R)	85°	85°	95°	95°
2(L)	80°	80°	92°	90°
3	82°	80°	94°	90°
4	95°	100°	112°	115°

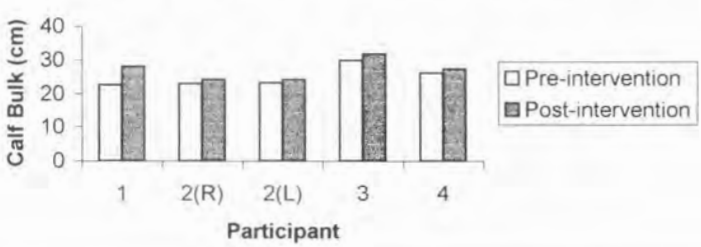
4. **Calf Bulk**

Muscle bulk increased in all four cases as is shown in Table IV and Figure 2. Although participant 1 demonstrates a dramatic increase in his muscle bulk during the first 10 weeks, the improvement is not maintained. However the other three participants showed a gradual increase in muscle bulk throughout the intervention period. Three of the four participants had hemiplegic CP and so the muscle bulk of the unaffected led was also measured, but the change was very small (Table IV). This would suggest that NMES was responsible for the muscle hypertrophy.

Table IV: Effects of NMES on calf bulk (cm)

Participant	*Pre-intervention*	*10 weeks*	*Post-intervention*	*6 weeks post-intervention*	*change*
1 affected	22.5	29.2	28	26	5.5
2 unaffected	33	33	32	n/a	-1.0
2 (R)	22.9	23.5	24.1	24.5	1.2
2 (L)	23.2	23.5	24.1	24	0.9
3 affected	29.9	30.6	31.8	31.6	1.9
3 unaffected	33.4	34	33.6	n/a	0.2
4 affected	26	26	27.2	27	1.2
4 unaffected	28.7	28.5	29.4	n/a	0.7

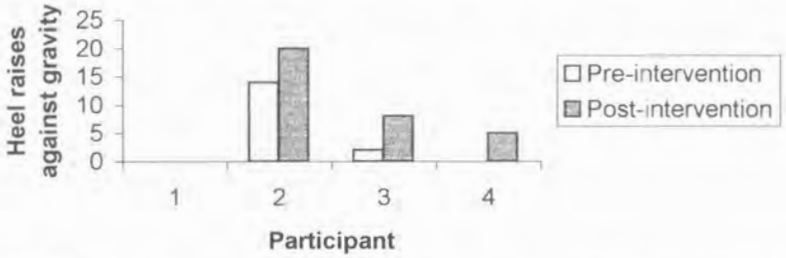
Figure 2: Group 1 calf bulk changes with NMES



5. **Calf strength**

Calf strength was measured by counting the number of full heel raises the participant could achieve against gravity while single leg standing as described by Lunsford and Perry (1995). The increases in strength gained are displayed in Figure 3.

Figure 3: Calf strength changes with NMES



In addition to the outcome measures above, participant's comments were noted when relevant to the intervention. All four spontaneously offered the information that their leg(s) felt stronger and two commented that they could work the muscle better. These comments are arguably as valid as other more scientific measures.

Group 2 Results

1. **Pediatric Evaluation of Disability Inventory (PEDI)**

This functional outcome measure takes the form of a questionnaire and has been widely validated (Reid *et al.*, 1993). The developmental effect of ageing is incorporated into the analysis. The data can be divided into functional skills and caregiver assistance. Means of the scores for all four participants are compared in Figures 4(a) and (b) and individual changes in the categories can be seen in Table V. All four show clinically significant functional gains.

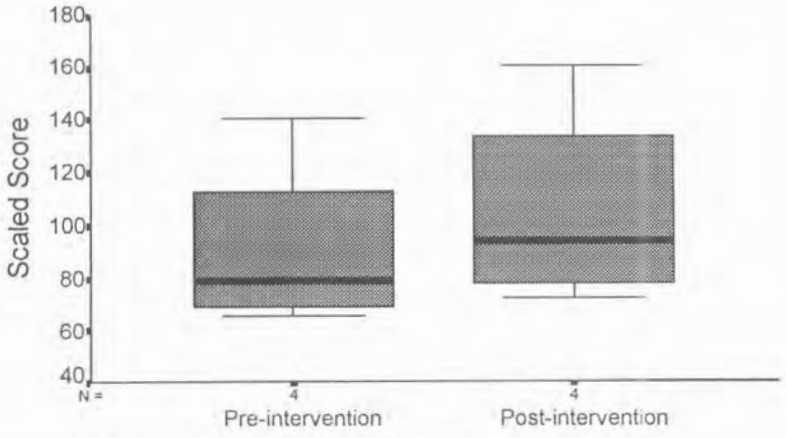


Figure 4(a): PEDI - Functional skills scores

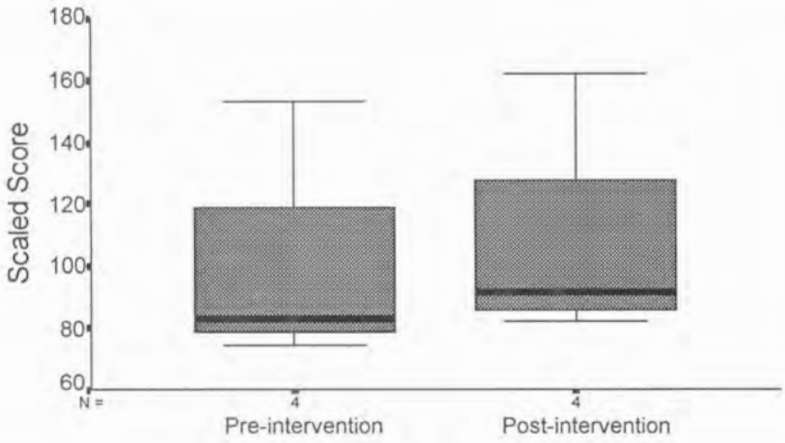


Figure 4(b): PEDI - Caregiver Assistance Scores

Table V: Scaled PEDI Scores - Changes with NMES

	Functional Skills		*Caregiver Assistance*	
Participant	*Pre-intervention*	*Post-intervention*	*Pre-intervention*	*Post-intervention*
5	140.4	161.1	153.6	162.1
6	85.8	105.6	74.9	93.2
7	72.6	83.3	82.4	82.4
8	65.7	72.2	83.7	89.5

2. **Hip ROM**

The participant's muscle tone was found to fluctuate according to a variety of physical factors including mood, digestive disturbances, level of relaxation and environmental factors which led to fluctuating ROM measurements. Overall, there was no measurable loss in any of the participants ROM, and although increases were documented, the relationship of cause and effect was considered too complex to draw valid conclusions.

However, as the study progressed, parents of participants 6, 7 and 8 repeatedly commented on how their childrens legs felt looser with less frequent crossing. Participant 7 began to make independent volitional movements of her hip midway through the intervention period, an ability she had not previously had. Participant 8 requested a machine of her own for home use because of the improved comfort NMES afforded her.

3. **Photographic record.**

Participants 6, 7 and 8 all demonstrated an improved supine position with less internal rotation and adduction at the end of the intervention period. An improved sitting position was observed in participants 6 and 8.

As participant 5 was ambulant it was considered appropriate to use additional outcome measures to measure strength and single leg standing. Hip abductor strength was measured by counting the maximum number of hip abductions possible in side lying to a set height of 40cm above the medial malleolus. The improvements observed along with improved single leg standing are detailed in Table VI. These changes may be significant when considered alongside the subjective observations of gait improvement. In particular, participant 5's post-intervention video shows quite clearly the improvement of balance in standing and the loss of the Trendelenberg. It may be that the increased hip abductor strength has resulted in a less hurried swing phase of gait.

Table VI: Participant 5's Outcomes with NMES

	Pre-intervention	*Post-intervention*
Hip abductions (R)	8	21
Hip abductions (L)	14	24
Single leg standing (R)	1s	4s
Single leg standing (L)	3s	4s

Discussion

The measurements generated from this study would appear to support the experimental hypothesis that NMES does indeed lead to improvement in muscle strength and function. However, caution is necessary as the study design lacks scientific rigour. The sample size is small and therefore not necessarily representative of the CP population as a whole.

There was potential for bias throughout the study as there was no blinding of the procedures. The data collector and the experimenter were one and the same. In addition, all the participants understood the nature of the intervention and may have been keen to report only positive outcomes. Nevertheless, the study in itself does not necessarily lack validity (Evans 1994) and there are clear trends that demand further attention. Within the series of single systems, patterns do begin to emerge. In particular, there was a tendency for the participants to gain in muscle bulk and strength with all of Group 2 reporting an improved ease of movement. Both the GMFM and the PEDI identified functional improvements in all of the participants. In order to ascertain whether or not the physical gains were retained, some measures were repeated six weeks post-intervention. For example in Group 1 the muscle bulk appears to have been retained at this stage in three of the four, but participant 1 had lost bulk. He had shown no improvement in strength and had restricted active ankle range of movement. This may suggest that unless the improved muscle bulk leads to functional gain then the muscle will return to its earlier form. This is an important point to note as it suggests the NMES should be used not in isolation but as an adjunct to other rehabilitation methods associated with

motor learning. The decrease in unwanted leg crossing in Group 2 is thought to be due to a gradual re-balancing of the musculature across the hip. The gluteus medius became palpably and visibly more active as the weeks progressed in all participants. It is however also possible that the decrease in leg crossing was due to the resultant stretch of the adductors during active assisted hip abduction work. Of the three non-ambulant participants in Group 2, two of their parents noted that by six weeks post-intervention, leg crossing had increased significantly again, though all three were of the opinion that standing remained better.

Participant 5 had retained her increase in strength and her parent noted that her walking was still less rushed at the six week period, suggesting that the transfer of physical gains had been made into functional acquisition. The once a week intervention may appear low, but based on the work of Carmick, we were keen to see if change would occur. Ozmun *et al.* (1994) have suggested that benefits derived from muscle training in children are most likely the result of learning and the enhancement of neuromuscular activation, rather than an increase in muscle size. This may account for the functional improvements that occurred.

Regarding the concern that NMES may result in increasing spasticity, certain findings are of interest. Of the eight study participants, one (participant 3) does appear to have deteriorated due to an increase in dynamic tone resulting in loss of heel strike. This is not necessarily related to the NMES, as it coincided with a period of rapid growth. All of the other participants reported either no differences or a sense of being looser following periods of stimulation.

Future developments

This pilot study has reinforced the belief that NMES, used during functional activities in accordance with motor learning theories of motor control, appears to provide the therapist with a useful tool in the treatment of children with cerebral palsy.

As a follow-up to this study, an experimental controlled trial is planned by Capability Scotland. As the available sample of children with cerebral palsy is small, a matched-subject design is likely to be the most appropriate. Intervention will be on a three times a week basis over eight weeks. The expected completion date is November 1999.

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HOW EFFECTIVE ARE LYCRA SUITS IN THE MANAGEMENT OF CHILDREN WITH CEREBRAL PALSY?

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Keywords
Lycra, pressure, pelvic stability, normalisation of movement.

Summary
This is the report of a study to try and evaluate the effectiveness of Lycra suiting in the management of Cerebral Palsied children. Fifteen children participated in the trial which was conducted over a period of twelve months. Whilst some children showed little change in the functional assessment, others showed a marked improvement, especially those with athetosis, ataxia and hypotonia.

Introduction & background

Limited work has been carried out on the effect of Lycra suits in children with Cerebral Palsy. Camp having been manufacturers of Lycra suits for burns victims had been approached by parents to manufacture a suit which could be used to help their children. They responded to this but felt that some trials should be conducted using the suit before embarking on full scale manufacture of the suit. Camp approached the paediatric physiotherapy team in Burnley to help them with the trials using children from their caseload.

This report illustrates our recordings, thoughts and reactions to the suit made during the trial. It is emphasised that the work was a trial conducted to assess the design and manufacture of the suit and to produce a discussion of the findings in the trial which we hope fellow therapists may find of interest and value.

What is the Lycra Body Suit?

The Lycra body suit fits closely to and completely covers the trunk, arms and legs. It is made as the name suggests of Lycra and consists of individual panels which are sewn together in such a way that pressure is exerted to the trunk and limbs. Zips allow for ease of application. Each suit is made to fit a child's individual requirements. The suit allows the child to move freely and there is no boning in the suit.

As a result of the trial Camp have produced several adaptations to the original suit such as short sleeves and legs, and experience has been gained as to where to apply pressure in the garments to achieve optimum effect.

Protocol

Before we could embark on the trial approval had to be sought from the ethical committee, following which the children who were to be asked to participate were selected. Various considerations were taken into account when the selections were being made. These included:

1. Degree of pelvic and shoulder stability

2. Ease of access for assessment purposes

3. Compliance from parents and school staff.

All parents were approached individually and the nature of the trial explained fully before they signed to give permission for their child's inclusion.

Fifteen children (eleven boys and four girls) with a diagnosis of Cerebral Palsy were selected from existing caseloads, their ages ranging from 2-12 years. The children presented with varying degrees of motor impairment, mobility and intellect. (Table I). An assessment was used which examined gross motor skills, balance and fine motor function and the results expressed as a percentage of the maximum score achievable. It is this score which is used in Table II.

TABLE I TABLE TO SHOW AGE AND CONDITIONS OF THE CHILDREN.

PATIENT No	AGE	DIAGNOSIS	MOBILITY	INTELLECT
1	5	HYPOTONIA	W/CHAIR	S.L.D
2	5	SPASTIC ATHETOID	W/CHAIR	M.L.D
3	12	SPASTIC ATHETOID	FRAME	M.L.D
4	2	HYPOTONIA	W/CHAIR	M.L.D.
5	8	SPASTIC QUAD	W/CHAIR	S.L.D.
6	11	SPASTIC ATHETOID	FRAME	M.L.D.
7	10	SPASTIC ATHETOID	STICKS	M.L.D
8	4	SPASTIC DIPLEGIA	W/CHAIR	NORMAL
9	4	SPASTIC QUAD	W/CHAIR	S.L.D.
10	5	SPASTIC DIPLEGIA	W/CHAIR	NORMAL
11	11	HEMI WITH ATAXIA	W/CHAIR	S.L.D.
12	8	SPASTIC ATHETOID	W/CHAIR	NORMAL
13	5	SPASTIC DIPLEGIA	FRAME	NORMAL
14	9	SPASTIC DIPLEGIA	FRAME	NORMAL
15	4	SPASTIC ATHETOID	FRAME	NORMAL

KE Y

S.L.D.= SEVERE LEARNING DIFFICULTIES

M.L.D.= MODERATE LEARNING DIFFICULTIES.

Following assessment the children were measured for their suit using the standard measuring procedure normally used for measuring pressure garments by Camp.

The suits were worn initially for two hours and this was increased by one hour a day until a wearing time of six hours was achieved. In the first week the suits were put on and taken off at school so that the children could be closely monitored and any adverse reactions recorded. Throughout the trial the children wore the suit for a minimum of six hours a day.

Each child was reassessed regularly throughout the trial whilst wearing the suit and any improvement/regression was recorded. At the end of twelve

TABLE II TABLE TO SHOW AGE AND CONDITION OF THE CHILDREN AND THE EFFECTS OF THE SUIT

PATIENT No	AGE	DIAGNOSIS	INITIAL SCORE	FINAL SCORE	AREAS SHOWING MOST IMPROVEMENT
1	5	HYPOTONIA	15.33%	36.83%	ALL
2	5	SPASTIC ATHETOID	22.17%	30.50%	GROSS MOTOR
3	12	SPASTIC ATHETOID	84.17%	87.50%	BALANCE,WALKING
4	2	HYPOTONIA	17.17%	26.17%	SITTING BALANCE
5	8	SPASTIC QUAD	46.67%	60.00%	FINE MOTOR
6	11	SPASTIC ATHETOID	70.17%	83.83%	ALL
7	10	SPASTIC ATHETOID	83.33%	88.67%	WALKING , BALANCE
8	4	SPASTIC DIPLEGIA	68.67%	76.00%	BALANCE ,FINE MOTOR
9	4	SPASTIC QUAD	39.00%	51.17%	FINE MOTOR
10	5	SPASTIC DIPLEGIA	60.83%	75.67%	ALL
11	11	HEMI WITH ATAXIA	60.00%	61.33%	FINE MOTOR,HANDLING
12	8	SPASTIC ATHETOID	45.83%	50.33%	FINE MOTOR
13	5	SPASTIC DIPLEGIA	64.67%	78.17%	BALANCE, FINE MOTOR
14	9	SPASTIC DIPLEGIA	75.17%	83.50%	FINE MOTOR
15	4	SPASTIC ATHETOID	70.17%	80.33%	WALKING, FINE MOTOR

months the children spent one month without wearing the suit followed by reassessment.

Results of previous assessments were not made available to the assessors at the time of reassessment at any stage throughout the trial.

Camp visited regularly and were able to make adjustments to the suits, discuss and rectify any problems and measure for new suits.

Photographing and videoing took place when appropriate.

Questionnaires were distributed to parents and carers on a regular basis asking for comments about the suit, particularly with regard to handling of the child and their ability in daily living skills.

Throughout the trial physiotherapy treatment sessions remained the same as before the trial.

Discussions of Findings

Initially almost all the children developed an erythema in the axilla which continued to be a problem for some children, especially the athetoids. As a result the design of the suit was modified and the problem alleviated.

At the end of the first week fourteen children were tolerating the suit well and were wearing it for a minimum of six hours - some for up to twelve. One child tolerated it for four hours but no more and this continued throughout the trial. During this week carers generally reported an improvement in sitting balance which was not apparent when the suit was

removed, although as the trial progressed it was observed that in many instances the effect of the suit was maintained for some time after its removal. After one month fourteen children showed an increase in their functional ability. One developed a hip problem which has since resolved and found not to have been caused by the suit. In addition to gross and fine motor improvements speech and language therapists reported improved breath control and, subsequently, speech particularly in one child with athetosis.

No respiratory problems arose with the children as a result of wearing the suit. In most children an increased confidence in their functional ability was noted which in turn enhanced their progress.

In subsequent months daily function varied according to behaviour, illness and tolerance but in follow up assessments there was an overall increase in scores. From the evidence shown in Table II the effect of the suit can be looked at according to the type of Cerebral Palsy.

Hypotonia

Of the two children with severe hypotonia the most improvement took place, perhaps quite significantly, within the first three months of the trial. Interestingly this was maintained during the month at the end of the trial when the suit was not worn. The youngest, aged two, gained improvement in trunk control and fine motor skills. The second, aged five had received physiotherapy since birth with limited results but upon wearing the suit he showed marked improvement in sitting and fine motor skills. This was remarked upon by all who cared for him. This child went on to begin to develop righting reactions which had previously been absent.

Spastic Athetoids

Six children fell into this category. Four of them showed steady progress with fine motor skills throughout the trial. The youngest child, aged four, demonstrated a marked improvement from first wearing the suit. Three of the four older children had been described as exhibiting static fine motor skills prior to the trial, so here some of the improvement could be attributed to the suit. These children also showed steady improvement in gross motor skills throughout the trial. Five of the six children all had particularly pleasing progress from a physiotherapy view in general handling, balance and walking. There was also a visible reduction in involuntary movements, this could be attributed to the compression of the shoulders, trunk and hips increasing central stability.

Spastic Diplegia

Four children with spastic diplegia were included in the trial, all with associated mild learning difficulties. During the trial all demonstrated improvement in fine motor control. Taking into consideration their ages and the fact that the improvement was gradual throughout the trial (including the one month without the suit) this could be due to a normal sequence of development. However all four showed improvement in sitting balance so this could have enhanced fine motor development. The two youngest had the most significant improvement in the first three months

suggesting perhaps the influence of the suit. The nine year old already had independent sitting balance prior to the trial. However this was with a marked asymmetrical posture that was immediately corrected upon wearing the suit.

Spastic Quadriplegia

Both children with spastic quadriplegia had most significant improvement in fine motor skills which is comparable with the diplegias. The youngest, age four, could have the results attributed to normal development but therapists felt in both cases that these children had better trunk stability in the suits enabling them to use their hands more effectively. The older child, age eight, showed marked improvement in sitting balance.

Hemiplegia with Ataxia

The results on this child are less conclusive, which can perhaps be attributed to behavioural and management problems and a large growth spurt throughout the trial. However, generally, he showed increased dynamic control in sitting, improved weight bearing, easier handling and more accurate control when using his communication aid. During the month without the suit at the end of the trial all persons involved with the child found handling more difficult, weight bearing unreliable and fine motor control less effective.

Parents Reactions (Table III)

There was a mixed response from parents. Whilst all have had something positive to say about the suit and the effect that it has had on their child, many did have problems, the principal one being difficulty in putting the suit on and resistance from the children in doing so.

Most parents found that the suit helped improve gross motor skills (most notably sitting and standing) more than fine motor. This does not altogether compare with our findings in which many children, especially the diplegias,

TABLE III PARENTS QUESTIONNAIRE AND RESULTS

QUESTION	NOT AT ALL	A LITTLE	A LOT	DONT KNOW	N/A
THE SUIT HAS HELPED MY CHILD	1	8	6	0	0
THE SUIT HAS HELPED MY CHILD STAND	1	6	8	0	0
THE SUIT HAS HELPED MY CHILD CRAWL	6	5	0	2	1
THE SUIT HAS HELPED MY CHILD WALK	0	9	4	2	0
THE SUIT HAS HELPED MY CHILD WRITE	4	4	2	3	2
THE SUIT HAS HELPED MY CHILD FEED HIMSELF	2	8	4	1	0
THE SUIT HAS MADE MY CHILD EASIER TO HANDLE	2	8	4	1	0
I LIKE THE SUIT	3	4	7	1	0
IFIND THE SUIT EASY TO PUT ON	4	7	4	0	0
I FIND THE SUIT EASY TO CARE FOR	3	3	9	0	0
MY CHILD IS HAPPY IN THE SUIT	2	5	8	1	0
I WOULD LIKE MY CHILD TO WEAR THE SUIT AFTER	4	3	7	1	0
THE TRIAL					

were found to have made most improvement in fine motor function. This is perhaps indicative of what a parent looks for in a child's improvement. One mother in particular feels that the suit has been instrumental in the progress that her daughter has made. She states :The suit to me has been the best thing for my daughter - she has been happier in herself and the suit has helped her co-ordination, balance, independence, fine motor skills and gross motor skills. She thinks her suit is magic."

Of the fifteen children who began the trial all wore the suit for its duration. We have seven children who have continued to wear the suit. Six of these children have athetosis, ataxia or hypotonia to some degree. The remaining child is a spastic diplegia. All have shown improvement in balance and walking.

Adverse Effects

Toiletting did prove to be a problem with some children, especially the girls, who sometimes wet the suit. Enlarging the hole helped a little to alleviate this problem. In those older children who had previously been independent in toiletting this independence was lost because the suit does need to be removed to have the bowels opened. Children also needed assistance in putting on and taking off the suit so again some independence was lost.

In summer some children did find the suit warm, we found in school it was mainly a problem when they were outside in an uncontrolled environment.

General Discussion

In our extensive reading whilst carrying out this trial we have come across many articles which helped us to understand how the suit could be affecting the children. In this discussion we refer to just a few of these articles.

Clinical observations and studies have shown that spastic subjects have a capacity for achieving control over movement when a suitable feedback is provided (Harrison & Kruz 1987) and adequate postural alignment and stability can improve the functional performance of children with Cerebral Palsy when sitting. (Brogren 1996). If the trunk control is poor it cannot be relied upon to provide a stable platform for the control of the lower limbs (Stallard 1996) and the learning process is disrupted.

Treatments designed using Roods sensorimotor approach are based on the understanding that normal development continues from stability in weight bearing to mobility in non weight bearing patterns. (Case Smith *et al* 1989).

By putting children in suits body alignment and trunk control was possibly being improved so sensory and motor feedback was enhanced and thus the learning strategies.

Proximal key points of control are used to give optimal amount of support or stability to promote distal control (Bobath 1964). In our treatment of children with Cerebral Palsy we aim to give proximal stability in accordance with the proximal to distal principal of normal development. This states that trunk stability and central control is necessary before upper and lower limb function is possible (Bobath 1964).

Therapists following the Bobath principal handle from the child's axilla, so as to control the scapulae and the whole arm. In this way the movement of the head, trunk, arms and legs can be controlled and any flexor or extensor hypertonus can be inhibited. The therapist may place their hands over the shoulders so that the clavicles, scapulae and head of humerus are covered. By doing this direction and varying degrees of pressure can be exerted as the movement progresses and there is a steadying influence on movement. These 'grips' firstly mobilise and lift the shoulder girdle and secondly align the trunk and arms so aiming to give increased stability. This is especially useful in the athetoid child who lacks postural stability (Bobath 1964). This stability was provided by the suit leaving our hands free to work elsewhere and increasing the child's potential to improve distally.

In some cases especially those with hypotonia, proprioceptive stimulation is given in the form of tapping, pressure, weight bearing and resistance in order to increase muscle tone. (Bobath).

By putting such children in the suit this proprioceptive input is being given continuously in the form of pressure and resistance. This pressure can be adjusted by minor alterations to the design of the suit so increasing its effectiveness.

Conclusion

The findings in the trial indicate that the use of lycra suiting in the management of Cerebral Palsied children can enhance function, improve posture and aid handling and can be a valuable adjunct to conventional therapy measures used in the treatment of these children. However compliance of all parties is imperative in its success.

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THE DAVID HART ORTHOTIC WALKING TRAINER

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L.A.H. - A CASE STUDY

Walking means more than simply the ability to ambulate: it means also having the ability to stand in an upright posture in a social situation, and there can be little doubt that it has an effect on the body image.

Posture and position have much to do with communication. Therefore anything which can assist in getting young people mobile will assist their communication.

Introduction

Genesis Orthotics Ltd. manufactures and supplies the David Hart Orthotic Walking Trainer. This consists of a made to measure body orthosis and a wheeled base with suspension unit. The two components combined make up the device.

LAH was born in October 1990 with hemimegalencephaly which eventually resulted in a left hemispherectomy i.e. the left hemisphere of the brain was removed.

She was referred to us by a professor of paediatric neurology at Great Ormond Street, her consultant paediatrician, and her physiotherapist.

Our remit was very specific. They wanted her upright and dynamically weight bearing whilst not compromising her posture.

'Good posture is a balanced condition that does not involve undue strain, in which spontaneous co-ordinated action in any part of the body is possible. It is not a static position, but a dynamic position.' (T. McClurg Anderson, Human Kinetics).

The referrers also wanted her to be hands free to maximise her independence and as learning is based on sensorimotor development, (Bobath K. 1980) the walker would allow her to explore and manipulate textures, shapes and temperatures and fulfil the postural criteria required.

With careful specific progression the outcome was that within 2 years of using the Orthotic Walking Trainer (OWT), LAH became independently mobile.

Background History

She was born by emergency caesarean section at 36 weeks gestation following a prolonged spontaneous labour.

The baby appeared normal but her mother noticed whilst in hospital that she did not cry or wake for feeds. She also noticed that there was a deep

red mark on the left hand side of the baby's head and that LAH only appeared to open her right eye.

An ultrasound was arranged and the results came back normal.

Once home LAH began what mum thought were temper tantrums whereby she became rigid with extended arms and legs, her head would turn strongly to the left and her face would become very red. These were intermittent and would last a short period of time.

Mum mentioned this behaviour to the health visitor and queried whether they could be a fit, whereupon LAH promptly had a major grand-mal. She was sent to hospital where epilepsy was diagnosed and appropriate treatment given.

The fits exacerbated and an M.R.I. scan finally revealed that she had hemimegalencephaly i.e. there were no sulci on the left side of the brain. The fitting from the left side of the brain was triggering fits from the right.

She was referred to Great Ormond Street and her parents were told that she was one of a hundred cases world-wide and that surgery was the best option. A left hemispherectomy was performed in June 1991, she was 8 moths old. Her parents were told that there was a good chance she would have severe communication problems, be unable to walk independently and that her cognitive ability would be poor.

Post operatively

She sat independently at one year post-op. She began asymmetric bottom shuffling at 18 months post-op and was beginning to pull to stand with assistance at 2 years post-op. However for the next 15 months she made little motor progress.

Assessment

Prior to our assessment we received reports from the aforementioned referrers indicating the following:

LAH had a dense motor and sensory deficit on the right, mild pyramidal signs on the left, general ligamentous laxity and very low central tone. She had been using a baby walker arrangement to 'scooter' about in.

The neurologist and physiotherapist were keen to try for reciprocal gait whilst controlling the trunk and pelvic instability. The position of the pelvis is paramount because the sacrum which is attached to the base of the spine is also part of the pelvis. As the pelvic connection is so strong, a change in pelvic position automatically leads to a spinal realignment,

especially in lumbar spine. (Golley P M).

L.A.H. was assessed by Genesis in April 1995. There were no contraindications to fitting and we informed her parents that our main objective was to achieve a good upright, dynamically weightbearing posture with LAH in a position to step. We were aiming to reduce the abnormal movement patterns that are acquired by a child to compensate for neural damage.

Fitting

The made-to-measure device was fitted in May 1995. Her posture was excellent and we achieved good stability within the trunk and pelvis whilst still allowing some voluntary rotation to occur. This rotation in the body axis between the shoulders and pelvis gives man an important feature of human mobility, and Kabat (1958) pointed out that rotatory patterns of movement alone are often effective in the cerebral palsied child to counteract hypertonus.

Bobath (1980) suggested that we do not learn a movement but the sensation of a movement. A child, whether normal or abnormal, can only use what he has experienced before. On that basis our decision was to pattern LAH from behind to reproduce and reinforce the sensation of controlled reciprocal walking. She started transferring weight almost immediately. This shifting weight helps prevent fatigue and contributes towards maintaining adequate circulation particularly in the postural muscles of the legs when standing. (Trew M., Everett T. Human Movement.) Initially she was able to step through with her right leg, but her left step was short. We concluded that the right leg did not hold the stance phase long enough to allow the pelvis to move forwards and consequently very little push-off occurred. The stance phase and push off in the left leg were good. We then used manual assistance to prolong the right stance and little games and exercises to encourage push-off. Although her stride length was a little uneven we all felt that for a first day of use it was an unmitigated success.

Progress

16-1.96 The first review was later than anticipated as LAH had been ill. The device was altered for growth. The hip and thorax had widened and the trunk had lengthened. She was given greater purchase on the floor. Steering was tried, but due to the stronger left leg push off leg she tended to go to the right only. To counteract this the steering was set so that she could only steer to the left or go straight. Our aim was to build up the use and strength in the left leg to gain some symmetry in steering. We also tried to teach her by repeated patterning how to go backwards, but at this stage she was not able to manage it.

24-4-96 At this review it was again adjusted for growth with 2 cm being added to the leg lengths. Steering was developing and she had mastered reversing. We reduced her trunk support but maintained the upright posture with her centre of gravity only slightly forwards when stepping to achieve as near normal a gait pattern as possible. She had a good heel strike on both the right and left. Her speed had accelerated and mum reported that her hand function was improving. She was able to use a pincer grip to get sweets out of a packet and a grasp grip to hold toys and cutlery.

That summer she entered the walking race at her special school in her walker. She did not win, but did complete the race, an achievement no one would have expected 12 months earlier.

12-8.96 At this review we carried on the progression with steering, creating challenges and tasks to be completed. From past experience we know that progression within the O.W.T. must be made in a cephalo-caudal direction so we carried on reducing the central support to allow her to control her upper trunk. The interaction of movement with speech development has been stressed by many workers. Abercrombie (1960, 1968) and Rosenbloom (1971, 1975) have found that limitations in the child's capacity for active movement retard the unfolding of his perceptual abilities, and in this way interfere with his over-all intellectual capacities. We were not too surprised that after LAH's vast increase in mobility that Mum reported an increase in vocalisation and further hand skill improvements in feeding and playing activities.

With these improvements LAH was able to take a pro-active part in family life. With the increase in motor skills she could go for short walks helping to push her baby sister in her buggy.

2-12.96 She had begun to alternate between the O.W.T. and a rear posture walker. This was now possible because her central tone, pelvic and trunk stability and hand function had improved considerably. We noticed that her knees were flexed and her right leg was noticeably externally rotated when ambulating in the rear posture walker. Flexed knees in standing prevents the postural fixation of the pelvis in the vertical plane and the counterposing mechanisms from operating efficiently for walking and for arm motion in standing. (Satirman, *et al.* 1997) Therefore within this device she used our orthosis with the left leg section removed, so that control was provided to the right leg to prevent the flexion and rotation. The result was that posture was not compromised but mobility was maintained.

Her development flourished and 4 months later she was walking independently. She had good speed, balance and posture apart from some external rotation of the right leg. Motor development is not a separate entity but profoundly influences all other aspects of the child's behaviour,

Bobath, 1980) and importantly the parents of LAH felt that her self confidence had escalated.

That summer she won the walking race at school. Mum said that nothing could compare to the feeling that her child had done it independently. An achievement they had never dreamt possible.

Conclusion

LAH is now 7½, and mum reports that her speech and comprehension increase daily and that her reading and writing are at reception level.

Socially she is much more interactive and now goes to the shops to buy her own sweets.

Her therapist, paediatrician, parents and ourselves believe that the walker allowed her to achieve a reciprocal gait pattern without compromising her posture. It enhanced her sensory input not only by dynamic weight bearing and postural management, but also by allowing her to freely use her hands whilst walking.

In short it allowed her to achieve her full potential.

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DOES A CHILD'S ABNORMAL DEVELOPMENT AFFECT THE PARENT/CHILD RELATIONSHIP?

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BSc (Hons) MCSP
Deputy Director
Craighalbert Centre

Expectations

When parents are told their baby is 'handicapped' their whole world is turned upside down. They and all their extended family had been anticipating and planning for a lovely little warm, gurgling baby. They have made plans for its future - but suddenly everyone's hopes are destroyed.

Firstly there is a huge feeling of loss for the child they had expected, that perfect baby. In fact they have a great sense of bereavement, something which is frequently forgotten by all the well meaning family, friends and professionals that may be involved. This emotion should be appreciated and the parents given the necessary help and understanding.

Information

The parents are also bombarded with information at this stage, 95% of which they probably cannot take in - they are in a state of shock. I am sure many of us have experienced the parents who swear they have 'never been told'. Of course they frequently have, but it is often all too much for them to absorb; something we need to remember when we are being asked the same questions over and over again. It is much better to give a few facts at a time and then make a point of returning to these again, to make sure everything is fully understood.

Pessimism

In the early days after a diagnosis and/or prognosis has been given, parents often comment that all the focus seemed to be on the child's disability; what the child cannot or will not be able to do. Doctors and professionals are often very pessimistic about the child's future and although it is important to give the parents a realistic outlook, care has to be taken to leave some hope - they have a lifetime ahead with their child.

Parents will often repeatedly return to the time when they were first told of their child's difficulties. How this news was broken to them can have a great affect on how they later handle situations and may cause long lasting damage.

Reactions

The reactions of family and friends to this new and different situation is often very hard for parents to come to terms with. Mothers have said that when taking their baby out in its pram, instead of a friend coming over to admire the new baby, they may cross to the other side of the road to avoid having to talk to the mother; they do not know what to say. Grandparents and other close family and friends are frequently at a loss as to know how to help as they too are in shock.

Steep Learning Curve

The majority of parents have never been involved in the 'world of the handicapped' and it is the steepest learning curve they will ever experience. Suddenly their home is invaded by a seemingly endless procession of well meaning professionals; a mother recently said she thought there were about eleven people coming to visit and she really could not remember all

their names or why they were there! In this situation parents are frequently given too much and often conflicting advice and in this horrendous new world they have been thrown into, who should they believe?

Loss of Identity

So often the child seems to lose its identity, it becomes the 'handicapped baby' or 'the one with cerebral palsy'. Its difficulties become its label and parents often feel their child now becomes a 'case'.

Bonding

But there are more intimate things that happen which can destroy the relationship between the child and its parents. Many babies are born prematurely and as a result they are immediately taken to a special care unit. If the mother has been allowed to hold the baby, it will have been briefly, and all too often all she is aware of is a quiet air of urgency as staff try to resuscitate her child. The baby may have been born by Caesarian section and thus the mother does not see the baby until much later. This all results in the loss of the initial close skin-to-skin contact between the mother and her baby. The importance of which has been highlighted by many. The parents first view of their new baby is often as a tiny scrap lying in an incubator surrounded by tubes and monitors - it is a terrifying experience. Parents are allowed to hold their babies as soon as the baby is medically stable but to hold a very small baby attached to tubes is not the same as holding a normal, cuddly baby

Wrong Messages

A baby, whether in hospital or at home can give its parents all the wrong messages. The child stiffens when picked up, it may scream, twist itself into abnormal postures or hold its hand tightly fisted. What is the baby saying to the parent? It would certainly appear to be telling them that it does not want to be lifted and that it dislikes their handling. We know this is not so, but we have been taught to understand abnormal behaviour, the parents have not and they need to be helped to appreciate why their child is responding in such a way. They need to know it is not their fault.

Communication

We also know that the quality of early communication which goes on between a child and its parents will substantially affect the child's development. A child with abnormal development will frequently have poor or even no eye contact with its parents, it will make few sounds apart from crying, it will not reach out to feel and touch, thus there is nothing for the parent to respond to. We all interact with babies and children, however young and we often follow their lead, these children do not have that ability and thus the parents feel the child does not want them and they feel rejected.

Feeding

Feeding should be a close, harmonious time for a child and parent but many of these children have severe feeding difficulties. They refuse to eat or drink, they may have to be tube fed - how must a parent feel if they cannot even feed their own child? - I would suggest, a failure. Then they have a child who cries incessantly and nothing they do will calm that child, again they feel a great sense of inadequacy.

What can we do?

To help these parents we must try to remember that they are now in a strange and difficult world and we should help them to understand why their child is like it is. They need to know that the baby is not stiffening or crying because it does not want contact with them.

We need to give the parents confidence in handling their child and not deskill them further by showing them how well we can handle their child! How must a mother feel when the child works well with us but when the mother tries to repeat our moves, the child screams?

Surely our role should be to guide the parents towards a greater understanding of their child, to show them how they can help their child to develop good patterns of movement but most importantly to give them the confidence to know that they are the experts with their child, not us.

The following two letters were received in response to the article on the Portage Walker in the December 1998 Journal.

DR ROBERT FARLEY,
CEng MIMechE
Principal Bioengineer
Special Needs Design Service

ELIZABETH HAZLEWOOD MCSP
Superintendent Physiotherapist
Anderson Gait Analysis Laboratory
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Dear Miss Wakley

The Portage Trolley Walker

The correspondence in December issue of the A.P.C.P. Journal raises a number of issues regarding: a) the interpretation of the Medical Devices Directive by designers in this field, b) the efficacy of this walking aid, and c) the general debate surrounding walking aids of any type for paediatric rehabilitation. Our perspective on these issues stems from professional involvement; our NHS department, (Rehabilitation Engineering Services), is primarily concerned with the *design* of devices for disabled clients with special needs such as posture aids, mobility aids and daily living aids. We are a Registered Manufacturer with the UK's Medical Devices Agency. As such we exercise design controls, if only as a matter of good professional practice.

The Medical Devices Directive

This Directive came into force on 14th June 1998. Manufacturers of Medical Devices who place such devices on the 'market', irrespective of fiscal sale, are obliged to comply with its *Essential Requirements*. Whether or not the actual device is CE-marked depends on circumstances, so for example a device which is specially built for a named individual as part of treatment or therapy need not be CE-marked. However it must be identified as a 'custom made'. Similar rules apply to devices on clinical trial. The purpose of the Medical Devices Directive is, in large part, to ensure patient safety[2]. The Directive *requires* designers to adopt procedures to detect possible flaws or hazards arising from a particular device. these can (hopefully) be detected using a formalised risk analysis[3] and a structured approach to validating the device, perhaps using a clinical trial or independent evaluation. It should be a matter of concern that the Medical Devices Directive seems to be regarded by some as a bureaucratic obstacle to progress and should be avoided at all costs.

Our knowledge of the Portage Trolley Walker is based upon the correspondence in the December issue. This device may have been intended mainly for children with non-specific 'motor delay'. However, the letter also mentions mild cerebral palsy. This fits the category of a device intended for the "alleviation of or compensation for an injury or handicap"[4], and so the design procedures associated with it should cover the *essential requirements* specified in the Directive. For example, there appears to be some concern from physiotherapists about the lateral stability of the device. Was a formal stability test ever done before releasing the walker? Were

the likely circumstances and ergonomics of its use risk analysed (as any other manufacturer of this type of device is now obliged to do)? Our own experience (below) is that simply subcontracting the manufacture of a medical device does not absolve the designer of responsibility from inherent ergonomic risks such as those associated with pressure points or stability - another reason to adopt the good practice outlined in the Medical Device Directive. The point here is to illustrate how the Medical Devices Directive can help, rather than hinder designers.

Comments regarding the Portage trolley walker's configuration

Our department has much experience in developing and modifying mobility aids. One device, The Arrow walker[5,6,7] has progressed to commercial manufacture. When using walkers, a disabled user's mobility is influenced by posture in the walker and the dynamic response of the walker. The ability to adjust these features was found[7] to be vital. The Portage trolley walker does not appear to have these adjustments, particularly those influencing the dynamic response. Physiotherapists familiar with the variety of similar walkers will appreciate that many are now equipped with variable friction brakes, directional locking castors and an over-size chassis to ensure a wide area of base and therefore stability.

One interesting feature of the Portage trolley walker could be the harness used by the child when in the device. From the description, it appears to be similar to a rock climber's 'sit-harness', i.e. a padded waist belt connected to (padded?) thigh loops. One drawback of other saddle-support or sling-support mobility aids is the tendency of the child to adopt a flexed position or simply slump onto the 'seat'. Sit-harnesses are designed for freedom of movement. Perhaps with a sit-harness the child will be discouraged from simply sitting: it is certainly an interesting idea, and worth investigating.

The pro's and con's of walkers

In the realm of this type of walker design, there is no ideal solution. There is some merit in the concern that these devices can promote unwanted patterns of movement. They can foster a dependency that cannot be serviced using the same technology in later life, particularly in the home environment, due to the practical consideration of scale. Contrary to this, the argument that they facilitate function and some independent interaction with the environment is also persuasive.

Yours sincerely

Dr Robert Farley, CEng MIMechE,

Elizabeth Hazlewood, MCSP

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1 The Medical Devices Directive, in the Official Journal of the European Communities L169, 12 July 1993. ISBN 0119122138

2 Article 2, in The Medical Devices Directive

3 BSEN1441: 1998. Medical Devices - Risk Analysis. See section 3 - General Procedure.

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Dear Lin,

I read with interest the article in your last journal about the use of trolley walkers and thought I would write as one had been offered, for use with children, to myself and my colleagues by our local Portage representative.

I am sure that what Mr Green and ASDA are doing is extremely worthy, but I feel he has not at all grasped the current litigious culture which exists in the N.H.S. He talks of therapists being overtly critical of his device and I would say they have every right to be when the trolley walker has no C.E. marking, and no approval as a medical device.

Mr Green does mention C.E. marking in his letter and states it is self-regulatory for class 1 devices, I wondered therefore why the trolley walkers have not already been marked, as it appears an easy process and Mr Green seems very sure of the devices' safety; it certainly would have saved Mr Green a whole lot of trouble and possibly meant he wouldn't have needed to use a disclaimer for the parents?

I think that once the trolley walker has approval as a medical device and its C.E. marking, that therapists will be only too happy to examine the walker and decide which children would benefit from using it. In fact it would probably be a great success bearing in mind its cost compared to other walkers.

In the meantime I would suggest therapists consult their Trust's legal advisors via line managers, so they can examine the documentation that came with the walker and see if they are willing to let their staff use the frame, and even if individual therapists are apprehensive it would be best left until approval comes through. Note also that there are alternative walkers of this type already on the market.

Yours sincerely,
Sue Booth (Senior Paediatric Physiotherapist)

SUMMARY OF ISSUES DISCUSSED AT THE APCP NATIONAL COMMITTEE MEETING HELD AT THE CHARTERED SOCIETY OF PHYSIOTHERAPY ON 15 JANUARY 1999.

1. Paediatric Physiotherapy Managers Group.
   The group plan to apply to become a sub-group of ACPM

2. Paediatric Involvement in Intensive Care.
   This issue now related to National frameworks development. A further meeting to be arranged.

3. ASDA/Portage Trolley.
   Numerous enquiries received. All physiotherapists advised to undertake a risk assessment prior to issuing the walker.

4. 1999 Jenx Award.
   As many departments did not receive an application form, members were advised to contact Jenx and seek a later closing date for entries.

5. ARC 1999.
   No proposals received

6. Memorial.
   Eileen Kinley agreed to attend the Celebration of Jennifer Bryce's life on behalf of APCP on 19.2.99

7 Public Relations.
   The PRO is seeking to create a register of working locations of paediatric physiotherapists in England and Wales.
   Sue Whitby (PRO) has been approached by a journalist keen to help us promote our profession. Suggestions for articles to Sue Whitby.

8. Education and training.
   The guidelines project is progressing well. The CSP have given their support to the idea of developing the physiotherapeutic aspects of a guideline. Judy Mead and Jill Robinson will lead a meeting on 19.5.99 for those members who have volunteered to assist with this project.
   Edinburgh MSc: Work continues on the development of this course due to commence in September 1999. Terry Pountney, Carole Hurran, and Angela Glyn-Davies accompanied by Scott Davidson (CSP Press Officer) met with Vince Gable, Liberal Democrat MP at the House of Commons recently. The CSP had approached him to add his support to the issue of therapy support to children with special educational needs in mainstream schools. Three areas of concern were identified as possible avenues to pursue. Scott Davidson will continue to liaise with Mr Gable on these matters.

9 Research.
   Following a number of enquiries on the use of electrotherapy it was decided that an article should be published in the APCP Journal. Tim Watson, CSP Research Officer to write this article.
   APCP research list to be updated.

10 CIG Liaison.
CSP Website: Proposed that the new site will have two functions;
a) to be an information source for members.
b) To be a source of information on CSP issues for the general public and a showcase for the CSP.
APCP Website: The committee discussed the feasibility of owning a website. Need to determine cost before making a decision.
Update of Standards Project: Project aims to devise a core set of standards for SIG's with add on appropriate to each specialist area.
Review of Clinical Interest and Occupational Groups: Proposed structure was published in Frontline in November. Gwyn Owen still asking for feedback.

11 Editors Report.
Central Mailing of APCP Journal: Each edition now costs of £3000 to produce. The system to be reviewed in July.

12 Membership.
Currently stands at 919.
Cost of collecting the Direct Debits this year was £600

13 Publications.
Three new items to be available at the AGM in April
a) Manual Handling Pack
b) Human Postural Reactions by Dr J. Foley
c) APCP leaflet. (updated)

14 APCP Conferences.
a) 1999 - Information concerning this conference will be sent to all members of the CSP. Details also to be found in the APCP journal.
b) 2000 - Venue: University of the West of England
Date: 4-6 May 2000
c) 2001 - To be organised by Trent region - CSP conference to be held in Glasgow this year.

15 Nominations are needed for new APCP National Committee members.

16 The next meeting of the National APCP committee will be on Friday April 16 1999 at the Royal Station Hotel Newcastle.

Mary Goy - Secretary

A full copy of the minutes can be obtained from your Regional Representative on request.

HOUSE OF COMMONS VISIT 26TH NOVEMBER 1998

Carole Hurran, Angela Glynn Davies and myself met with Liberal Democrat MP Vince Gable in November to discuss issues relating to the provision of physiotherapy services to children with physical disabilities in mainstream schools following the government's Green Paper on Special Educational Needs. The meeting resulted from the CSP press officer, Scott Davidson, contacting Mr Gable following his questions in the House on a similar topic. He invited Mr Gable to meet with APCP to pursue the issues further.

Our visit to the Commons began in the lobby with the pomp & ceremony of the speaker processing into the chamber. This was followed by a meeting in a tea room with Mr Gable.

He was extremely interested in the issues we raised and suggested we identify three main points on which to focus. After some discussion it was decided that he would focus on the provision of properly resourced designated schools in each locality, the identification of funding for services & equipment where health, social services and education are involved and the recruitment and retention of paediatric physiotherapists. Scott Davidson will maintain the contact with Mr Gable and it is hoped that he will be able to help improve the provision of our services to this group of children.

Terry Pountney
Education Liaison Officer

From L to R Angela Glynn Davies, Carole Hurran and Terry Pountney

PRIVATE PRACTITIONER'S REGISTER

Do you treat children privately, or do you wish to do so?

APCP maintains an annually updated register of private practitioners working with children which it distributes to parents on request.

Please complete the form below if you wish to join or remain on the register for 1999-2000.

Private Practitioner's Register

Name ..... CSP no: ..... APCP no: .....

Contact Address .....

..... Tel. no: .....

Qualifications: .....

Clinical speciality/interest: .....

Do you work full time or substantially in private practice? Yes/No

Are you able to treat patients (please tick)

Daytime	❑	In their own homes	❑
Evenings	❑	In a private clinic	❑
Weekends	❑		

Are you a member of OCPPP? Yes/No

Further information from and completed forms to:

Ms D Coggins, 7 Union Street, High Barnet, Herts NE5 4HY.

TAX RELIEF: UK MEMBERS:

You can claim tax relief on your CSP subscriptions by quoting Section 201 ICTA 1988 in your tax return to the Inspector of Taxes (this will reduce the cost of your CSP subscriptions by 23% after you get your tax relief). You may also be able to claim for your CSPM subscriptions under the same tax section, but please liaise with that organisation (Tel No. (CSPM) 0171 582 0866).

TAX RELIEF

CSP: 0171 306 6666

		Annual	Monthly Direct Debit
Subscription	1994	£112.00	£9.80 x 12 months
	1995	£124.00	£10.85
	1996	£128.00	£11.20
	1997	£136.00	£11.90
	1998	£149.00	£13.05
	1999	£149.00	£12.95

CPSM: 0171 582 0866

1994	£17.00	1995	£17.00
1996	£17.00	1997	£17.00
1998	£17.00		

APCP membership fees may not be accepted by some tax offices, but the figures are:

1994	£16.00	1995	£17.00
1996	£18.00	1997	£18.00
1998	£21.00	1999	£21.00

The tax office will amend details and give refunds up to six financial years.

SCOPE LEAFLETS - "HELPING PHYSIOTHERAPY TO HELP YOUR CHILD"

NB Change of phone number

If you require copies of this leaflet please do not contact the SCOPE helpline as previously advised as this number is staffed by trained counsellors to talk to distressed parents.

Please phone SCOPE Administration Department Library on 0171 619 7341. If you require large amounts of leaflets these will be dispatched from SCOPE's Watford warehouse and may take at least a week.

Sorry for any confusion!

Please encourage all physiotherapists to use this leaflet produced by SCOPE and APCP.

Sue Whitby
Public Relations Officer

APCP PUBLICATIONS

Title	Price	Quantity
Serial Splinting in Hemiplegia Cerebral Palsy by Margaret Jones (2nd Edition)	£3.50	
The Children Act 1989 'A Synopsis for Paediatric Physiotherapists'	£2.50	
Paediatric Physiotherapy Guidelines for Good Practice	£2.50	
Dyspraxia - A Handbook for Therapists by Michelle Lee and Jenny French	£5.50	
Guidelines for Calculating Caseloads	£1.00	
Baby Massage	£1.00	
Standards of Practice for Paediatric Physiotherapy	£2.50	
Statutory Assessment of Children and Special Educational Needs	£4.00	
Test and Measures Resource Pack (2nd Edition)	£3.50	
Haemophilia Booklet	£3.50	

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	6 -10 copies	£2.50
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Total	**£**

NEW PUBLICATION

Human Postural Reactions - Lessons from Purdon Martin by Dr. John Foley £5.00 (incl P&P)

TERMS: ** STRICTLY CASH WITH ORDER **

** Cheques and postal orders should be made out to "APCP Publications" and included with order.

SEND ORDERS - WITH PAYMENT TO:

Eileen Kinley, Superintendent Physiotherapist
Royal Liverpool Children's NHS Trust
Alder Hey Hospital
Child Development Centre - Physiotherapy Department
Eaton Road, Liverpool, L12 2AP

Name and address for delivery: .....

.....

.....

APCP RESEARCH DATABASE

If you are undertaking research, please fill in the form below and return it to Carrie Jackson, Research Officer, 4 Abbotsway, York, YO31 9LB. The information will be used as a resource for other researchers and to help inform the CSP about members research interests.

1. Names of researcher(s) Qualifications of researcher(s) Current Job title

i) ....

ii) ....

iii) ....

2. Contact address .....

.....

.....

Post code ..... Telephone ..... Fax .....

3. Title of project .....

.....

4. Please suggest up to four key words which best describe your project.

i) ..... ii) .....

iii) ..... iv) .....

5. If possible, please give a brief summary of the project, especially the aims and expected application; please use a separate piece of paper if necessary.

.....

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.....

6. Funding source or grants if any

.....

.....

6. If this study is for a degree, please state which level .....

7. Start date ..... (expected) completion date .....

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LONDON REGIONAL

(Free Congress Registration Fee)

To be eligible for one of the three free places being offered by the London Branch Please send your name, and address, together with one suggestion for a Study Day for the Year 2000 to:

Devala Dookun

Great Ormond Street Children's Hospital

Great Ormond Street

London WC1N 3JH

The draw will take place at the next Committee meeting on 12th May. Please note the winners will be responsible for themselves for all other costs connected with attending Congress in Birmingham which will be held on 8th - 10th October 1999.

Only members of the London Branch can take part.

ANN SHANKS

SOUTH EAST

SE Region are planning three study days this year: In March a two day course on Neuromuscular and Bone & Muscle Plasticity with workshops on how to put theory into practice is planned. A free study day in June will be on Neonatal Care, Respiratory and Neurological Aspects and a day in the Autumn of transition of children with disabilities into secondary school.

Following our meeting at the beginning of February we will send out final details of the study days.

Please let us know of any ideas for further study days.

TERRY POUNTNEY.

NORTHERN IRELAND

Firstly, an apology. Due to some "gremlin" trouble the last two regional representatives reports weren't in the Journal!

Our two evening meetings to date have been well supported. We had an update on Cerebral Palsy with speakers from NICOD, and the Gait Analysis Laboratory in Musgrave Park Hospital. The best-supported evening was 24 September, 1998, when we were very honoured to welcome Mary Lane and Dianne Russell who spoke on GMFM, and their work in Paediatric Physiotherapy.

Unfortunately, the Michelle Lee Dyspraxia Course was postponed in November, but it will now be held on 26 February, 1999, in Craigavon Physiotherapy Department. We are also hosting a two day Introduction to Bobath Course on 15 and 16 April 1999, in the College of Nursing, Antrim. Susan Horsburgh is the tutor, and further details can be obtained from the Bobath Centre.

the AGM is on 15 March 1999, at 7.30 pm in the Post Graduate Centre, Antrim Hospital and a good turnout would be appreciated.

ADARE BRADY.

TRENT

A successful study day on Postural Management of Children with Complex Special Needs was held in November. It is hoped to arrange follow up meetings to share good practise.

The committee is keen to run further study sessions around the region and will be looking for the membership to make suggestions at the A.G.M. This is to be held in March with a lecture on Anterior Knee Pain, date to be announced.

The finances remain healthy which will support the use of guest speakers at lectures.

Video library to be introduced in 1999.

Bursaries to support members attending courses have also been introduced and will be publicised in a newsletter to be sent to all members in February.

ANN PETERS.

WEST MIDLANDS

Firstly may I take this opportunity to welcome any new members that we may have in the region this year, and remind you all to encourage all your friends to join us. Our AGM is on March 20 combined with a short study day on Gait Analysis led by Nicky Thompson and Sally Rossiter from Oxford. It will take place at The Education Centre Birmingham Children's Hospital between 10.30 am and 2.45 pm approx. Lecture fee is £5.00 for members and £7.50 for your colleagues, payable on the door. (You will need to make your own arrangements for lunch, although light refreshments will be served mid morning). Keep your eyes open for evening lectures

which will be taking place over the spring and summer these will be announced shortly.

SALLY BRAITHWAITE.

SCOTTISH REPORT

Scotland hosted both part A and B of the Halliwick course last year and they proved extremely popular and successful. Our thanks to Kim Peacock, Ros Krys, Phillips Puckrin and their associates who left the delegates exhausted, excited and bursting with enthusiasm!

We also ran a very successful day on Osteogenesis Imperfecta which was very well attended.

Our A.G.M. this year is on March 19th in Falkirk. The day will include short talks by various members on current topics of interest, finishing off with a practical session on Reflexology to send everyone home relaxed and at peace!

The committee's efforts are being focused on The Introduction To Paediatric Course being held in Glasgow (information in previous journals). The programme is virtually complete and will be exciting and stimulating with many expert speakers. The venue, catering etc., is all organised and the applications are trickling in! A flood of applications would be really appreciated!

As are all paediatric physios, we are struggling to reconcile the Manual Handling Regulations and the optimum treatment we want to give our children. Most of us are finding it hard to be sure that we are getting both right!

The Scottish membership has dropped quite a bit from last year, but hopefully the stern letter I sent out to the non-rejoiners will have the desired effect!

Every good wish for 1999

CHRISTINE SHAW

SOUTH WEST

The AGM/Study Day is on Saturday 13 March at Dorset County Hospital, Dorchester. Topics to include update on multi-level surgery, cranio-sacral therapy, talipes and hip problems. Cost is £20 for members, application details are available from me.

The Wessex CP Workshop on the older child (16+) has been delayed but should be arranged for sometime in March. The next Study Day will be on orthotics in June or July. Contact me for further details.

We do need one or two new members on the Committee and it would be particularly nice to have some representation from the more westerly end of the region. Please contact me if you are interested.

There are two Senior II vacancies (1FT, 1PT) coming up at Portsmouth but final details of the posts are not yet available. Contact Sylvia Longman, Superintendent Physiotherapist at the CDDC, 10705 894410 for further information.

PAM EVANS

EAST ANGLIAN

During the Autumn, the East Anglian region ran an excellent day course at Hungtingdon on the Primary child with CP. Colin Stevens was the speaker. It was very well attended and was very thought-provoking.

On 6th March at the C.D.C. Addenbrook's Hospital we are having our annual A.G.M. and Study Day. The subject is 'Orthotics' given by Martin Matthews of Camp. Already much interest is being shown by members. Do just come along and 'pay at the door'.

TRICIA BROSNAN

NORTH EAST

We had an overwhelming response to our Study Day on 'Developmental Co-ordination Disorder'. It was fully booked within two weeks of advertising it!! We intend to re-run it later in the year so those of you who applied and were unsuccessful will get another opportunity. Also those of you who would like to go on the waiting list for the next one please get in touch with Jane Howland.

The committee intend to set up a video library for our NE members in the very near future and would appreciate any titles for purchasing.

We need topics and ideas for future study days in 2000. If you have the name of any speakers/ facilitators for such courses they would be greatly appreciated.

Next Study Day for your diary is:

Date: Saturday 15th May 1999

Venue: North Tees General Hospital, Stockton

Subject: Coping with loss.

MARY HARRISON

NORTH WEST

Our next study morning on March 6th will combine the A.G.M. The Topic is Botulinum Toxin.

We are looking forward to welcoming Mr Rolfe Birch and his team from Stanmore to our Study day on Erbs Palsy - May 14th at Warrington - see the course adverts for more information. It will be a multidisciplinary day so please tel OT, nursing and medical colleagues.

The November course is planned to look at "Control in lying, sitting and standing". Please keep more suggestions coming in: more additions for our Video library we now have "12 months of normal development". We aim to buy the new Paediatric Hydrotherapy Video from Australia.

Study Bursaries are still available for local members - contact Lorna Stybelska at Royal Manchester Children's Hospital.

SUE WALMSLEY

WALES

A study afternoon introducing Critical Appraisal Training was held in January, in conjunction with the Clinical Effectiveness Support Unit at Llandough Hospital. It was well attended and has inspired further training afternoons and group discussions on Clinical Guidelines.

In February, there was a social get-together to celebrate the Chinese New Year at Aberkenfig, with some Lion Dancing (and not Line dancing as originally thought!)

On April 26th and 27th there is a 2-day course on Gait Analysis with Elaine Owen at the Hensol Conference Centre. Places are limited so make sure you apply asap! And on that Monday night, following the AGM, there will be a social evening of wine tasting at Llanerch Vineyard!

Nothing more to report at present but if there are any requests/suggestions to add to next year's programme, please contact me! See you all at the AGM!

SIAN HOWELLS

CALL FOR ARTICLES

The September 1999 Journal will be entitled Syndromes.

If you wish to write a case study of a child with a rare or unusual syndrome for inclusion in the September 1999 Journal please send it to the editor before **1st August 1999.**

NORTH WEST
MULTI-DISCIPLINARY
STUDY DAY FOR
ERBS PALSY

Date: 14th May 1999
Venue: Education Centre, Warrington General Hospital
Cost incl. lunch: £35 APCP members, £50 Non-members
For application forms please contact:
Lesley Turner,
Superintendent Physiotherapist
Queens Park Hospital,
Blackburn
BB2 3HH
Tel: 01254 293758
Closing date 30th April 1999

WALES
GAIT ANALYSIS AND AGM

Date: April 26th and 27th 1999
Venue: Hensol Conference Centre, Mid Glamorgan
Tutor: Elaine Owen
Superintendent Physiotherapist
Ysbyty Gwynedd
North Wales
Cost: £ 90.00 APCP Members, £ 110.00 Non-members
Places limited. Closing date 31.3.99
For further information please contact:
Sian Howells,
Physiotherapy Department,
Llandough Hospital
Penarth,
Vale of Glamorgan
Tel: (01222) 715474 or 715591

NORTH EAST
COPING WITH LOSS

Date: Saturday 15th May 1999, 9.00 am - 4.00 pm
Venue: North Tees General Hospital
Course Tutor: Various Speakers
Fee: APCP members £20.00, Non-Members £25.00
Please make cheques payable to APCP - NE
Send to:
Jane Howland - Treasurer
8 Piper Road
Hutton
Driffield
East Yorkshire
YO25 9YY
Tel: 01377 270149

SEATING & EQUIPMENT EXHIBITION

Wolverhampton Healthcare Paediatric Physiotherapy Department
Date: Wednesday 21 April 1999, 1.30 pm - 5.30 pm
Venue: United Reform Church, Lea Road, Pennfields, Wolverhampton
Light refreshments available
Companies invited to exhibit include:

Kendal/Camp	Mobility Aids	SOS	Kirton
Lecky	Scandic Rehab	Theraplay	Rifton
Jenx	Quest	Symmetrikit	TFH
Rainbow Rehab	DCS	Smirthwaite	Taylors
JCM Seating			

For further details and directions please telephone:
Pat Escott
West Park Hospital
Tel: 01902 444282
or Cynthia Tilley
Child Development Centre
Tel: 01902 307999 ext. 2439

AN INTRODUCTION TO NEONATAL PHYSIOTHERAPY

Date: 1st - 5th November 1999
Venue: "Arnham Galleries" Fairfield Halls, Croydon
The course consists of comprehensive lectures designed to educate qualified physiotherapists in all aspects of neonatal care.
It is also aimed at neonatal nurses, speech and language therapists and occupational therapists - working in this field.
The course has been formatted to allow participants to attend the whole week or individual days.
Topics include:
Respiratory care
Developmental assessment and care
Nursing care and feeding issues
Other aspects of intervention by specialist medical and nursing staff and therapists
An introduction to Joan Lacey's neurological assessment of the preterm infant.
Cost: £40 per day, £190 whole week
Lunch and refreshments provided
Contact for full details and application form:
Alison Carter
Snr. Paediatric Physiotherapist
Physiotherapist Department
Mayday Hospital
London Road
Croydon
Tel: 0181 401 3093
Closing date 31st August 1999

ACUTE PAEDIATRICS COURSE

Date: 10th - 14th May 1999
Venue: Clarendon Wing, Leeds General Infirmary
Course Details:
A 5 day course encompassing mostly respiratory and neurological aspects of acute paediatrics. It is aimed at therapists with existing paediatric experience or those wishing to specialise.
Topics covered include: Neonatal Care, PICU, HDU, General Paediatric & Neurosurgery, Head Injury Management, Early Rehabilitation.
Days 1 & 2 are for physiotherapists
Days 3 - 5 are open to the whole multidisciplinary team
Cost: £225 for all 5 days, £50 per day
Further details:
Pam Price MCSP & Sarah Hibbert MCSP
Paediatric Therapy
Clarendon Wing
Leeds General Infirmary
Belmont Grove
Leeds LS2 9NS
Telephone: 0113 3926610
Fax: 0113 3923720
Closing date: 5th May 1999

WHIZZ-KIDZ THE MOVEMENT FOR NON-MOBILE CHILDREN 'A TEAM APPROACH TO CHILDREN'S MOBILITY 'PAEDIATRIC MOBILITY CONFERENCE'

Date: 9 June 1999 10 a.m. - 4.30 p.m.
Venue: Bristol
How many people does it take to carry out a holistic assessment for a paediatric Mobility Aid?
Physiotherapist? Occupational Therapist? Rehab Engineer? Social Worker? Supplier? Parents? Child?
Tell us what you think!
Chair: Dr Robin Luff (Chairman Posture & Mobility Group)
• Assessments examined! - hear the views of parents, children, therapists and suppliers on assessments.
Perspectives from : Physiotherapist, Occupational Therapist, Orthotist, Rehab Engineer, Dealer.
• Opportunities to see the latest equipment in our exhibition.
• The Conference will be open to professionals working within the field of mobility, suppliers, children and families.
Cost: £60 Professionals.
For details contact Ceri James
Whizz-kidz,
1 Warwick Row,
London SW1E 5ER
Tel: 0171 233 6600
Fax: 0171 233 6611.

"THE CRAIGHALBERT MODEL - CONDUCTIVE EDUCATION IN A SCOTTISH CONTEXT" A 5 DAY SHORT COURSE

Date: Monday 3 to Friday 7 May 1999
or Monday 30 August to Friday 3 September 1999

The course aims to:

- Give an overview of the aims, philosophy and practice of conductive education, within a Scottish context, as developed at the Criaghalbert Centre.
- Give participants an understanding of the significance and effects of a curriculum which incorporates the principles of conductive education within a local setting.
- Give participants an understanding of the problems children with cerebral palsy are likely to have and the solutions offered by conductive education.

The Programme includes:

- The background of conductive education and the context in which it operates at the Craighalbert Centre.
- The aims, philosophy and principles of conductive education
- Children with cerebral palsy - problems and solutions
- Observation of groups
- How to plan for the whole day
- Transition to mainstream provision

Cost: £300 incl. coffee, lunch etc.
If overnight accommodation is required or for further information contact:
Dr Lillemor Jernqvist, Director
Craighalbert Centre
1, Craighalbert Way
Cumbernauld G68 0LS
Tel: 01236 456100
Fax: 01236 736889

PAEDIATRIC PHYSIOTHERAPISTS IN MANAGEMENT SUPPORT (PIMMS) STUDY DAY/WORKSHOP PAEDIATRIC MANAGEMENT ISSUES

Date: 29th June 1999
Venue: Neville Butler Lecture Theatre
Institute of Child Health
Bristol Children's Hospital
Led by: Sue Skewis from the CSP
Cost: £20 - Lunch not included
For all Paediatric Physiotherapists interested in Management.
For further information please contact:
Jane C Pyman,
Superintendent Physiotherapist,
Physiotherapy Department,
Bristol Children's Hospital,
St. Michael's Hill,
Bristol
BS2 8BJ
Tel No: 0117 928 5525

EUROPEAN ACADEMY OF CHILDHOOD DISABILITY

11th ANNUAL MEETING

to be held at

THE SENATE HOUSE,
UNIVERSITY OF LONDON

OCTOBER 21st to 23rd 1999

Call for Papers

This meeting is now making a call for papers. Abstracts of papers or posters should be submitted to the Secretary, EACD, The Wolfson Centre, Mecklenburgh Square, London WC1N 2AP by 31st May. Abstracts should be submitted on A4 paper and on disk in Word or WordPerfect and be no longer than 300 words. The Scientific Committee will notify applicants of the acceptance of their paper or poster by June 30th. Please state clearly whether your abstract is of a paper presentation or a poster display.

INVITED SPEAKERS INCLUDE

Leland Albright, Christopher Gillberg, John Mantovani, John McLaughlin, Paula Tallal

Put these dates in your diary now

A full registration pack will be sent to all members shortly.

Non-members should write to the secretary at the address above.

UNIVERSITY HOSPITAL LEWISHAM PAEDIATRIC ORTHOPAEDICS

SENIOR I PHYSIOTHERAPIST

(Full time/Part time - hours negotiable)

This exciting new post offers an excellent opportunity for an experienced paediatric physiotherapist to develop his/her orthopaedic skills. This acute Trust includes a large children's unit which is expanding its orthopaedic service. Your rôle will be to contribute to the development of the orthopaedic paediatric service both on the wards and in the clinics, working closely with the orthopaedic and paediatric consultants and the community teams. The paediatric unit (98 beds plus day care) comprises an ITU, Medical and Surgical wards and a neonatal unit.

You will be managing a caseload of orthopaedic trauma and cold surgery, which includes children with congenital and neurological conditions both as in- and out-patients, including hydrotherapy. You will also assist the four qualified physiotherapists in the paediatric team with the general paediatric work, including paediatric surgery, neonatology and Cystic Fibrosis.

We can offer:

- a varied caseload in orthopaedic paediatrics.
- opportunities for training and development - clinical, teaching and managerial.
- participation in clinical audit and quality initiatives.
- experience in the supervision and development of students and staff.
- a new Academic Centre with excellent facilities for education and research including a multi-disciplinary library.
- a purpose built department with a well equipped gym, hydrotherapy and out-patients area.
- modern staff accommodation.
- a friendly working environment in a developing Trust.

For further information or to arrange an informal visit please contact Pat Aste, Therapy Manager, Physiotherapy Department, University Hospital Lewisham, Lewisham High Street, London SE13 6LH on 0181 333 3000 ext 6377/6.

NORTH WEST ANGLIA HEALTHCARE TRUST

SENIOR I/II FULL-TIME PAEDIATRIC PHYSIOTHERAPIST

£15,785 to £21,485 depending on experience.
Based at The Child Development Unit, Peterborough.

A physiotherapist is required with a keen interest in Paediatrics, and a commitment to a quality service for children.

You will enjoy working in the community setting, based at the Child Development Unit covering nurseries, home visits special and mainstream schools. There is also the opportunity for hydrotherapy.

The children come from a variety of ethnic and cultural backgrounds with a diversity of conditions.

We have a specialist physiotherapist for Juvenile Chronic Arthritis, a clinic run by a physiotherapist and visiting Orthotist and multidisciplinary pre-school groups within the C.D.U. We are part of the multidisciplinary assessment process and, the combined medical/education review of children.

Training is encouraged, we have regular multidisciplinary training in addition to our own in-service training and possible funding for the eight week Paediatric Bobath course.

We have good liaison with Hospital and Community Children's Services.

Research and C.P.D. are actively encouraged.

A clean driving licence is essential.

For enquiries and application form, job description or an informal visit please contact Mrs. Ruth Hilton, Head Paediatric Physiotherapist at Child Development Unit, Peterborough District Hospital, Thorpe Road, Peterborough. PE3 6DA.

Telephone: (01733) 874718. Please quote reference AH 98/99.10

Closing date: 12/3/99

Expected interview date: 25.3.99

Hinchingbrooke Health Care NHS Trust

INTEGRATED CHILDREN'S & LEARNING DISABILITIES SERVICES

PAEDIATRICS/LEARNING DISABILITIES SERVICE
SENIOR I PHYSIOTHERAPIST

Come and join our multi-disciplinary team working in the community with children of all abilities and people with learning disabilities. Opportunities will exist to develop this service with the help of other professionals.

We are committed to individual professional development and attendance at regular continuing development sessions is encouraged.

Hinchingbrooke is an Intergrated Acute and Community Trust providing seamless care to the population of the historical market town of Huntingdon and its surrounding areas.

Huntingdon is 1 mile from the A1/A14 and is within 20 miles of Cambridge and 55 minutes by rail from London.

A current driving licence is essential.

For further information please contact Mrs Katy Searle, Superintendent Physiotherapist on (01480) 415203.

Application by CV with details of 2 relevant professional referees to Lynn Beeke, Learning Disabilities Service, Hinchingbrooke Health Care NHS Trust, Primrose Lane, Huntingdon, Cambs PE18 6SE, quoting our reference LDS/250.

Working Towards Equal Opportunities

Notes for Contributors

The Editorial Board welcomes research material; referenced articles and evaluations of physiotherapy practice; informal articles.

Manuscripts should be sent to Lin Wakley, 2 Ash Bank, Pipers Ash, Chester, Cheshire, CH4 7EH, U.K.

Copy to be submitted should be typed on one side of the paper, double spaced and with ample margins. All pages should be numbered consecutively.

Manuscripts should provide the title of the article and the author(s) name(s) and full postal address for correspondence.

References should be given in the Harvard System.

In text	Author(s) name and initials followed by the date of publication. Use a,b, to indicate more than one publication in the same year. Where there are 3 or more authors use first name followed by et al.
For books	Laszlo, J. & Bairstow, P. (1985) *Perpetual Motor Behaviour* (Rinehart and Winston)
For chapters within books	Morley, T.R. (1992) Spinal deformity in the physically handicapped child, in : G.T. McCarthy (Ed). *Physical Disability in Childhood* (Churchill Livingstone)
For articles	Scott O.M., Hyde S.A., Goddard C.M., Dubowitz V., (1981a) Prevention of deformity in Duchenne muscular dystrophy. *Physiotherapy* 67(6), 177-80.

Tables and Figures

The approximate position of the tables and figures should be indicated in the manuscript.

Keys to symbols should be included.

Tables should be numbered by Roman numerals and figures by Arabic numerals.

Figures should be supplied in a finished form, suitable for reproduction. Figures will not normally be redrawn.

Proofs will be sent to authors if major alterations have been made to the text.

The Editorial Board reserves the right to edit material submitted for publication.

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In this issue

THE MANAGEMENT OF CHILDREN WITH CEREBRAL PALSY

A Study of Hips

Postural Management

Neuromuscular Stimulation of Spastic and Non-spastic Muscles

Lycra Suits

The David Hart Walker

The Parent/Child Relationship