POSTURE AND MOBILITY

Volume 29:2 Winter 2012

The Journal of the Posture and Mobility Group

AQP

Pressure Ulcers

Outcome Measure

THE PATIENT VOICE IS NOT NEW: PATIENTS HAVE MADE THEIR VOICES HEARD FOR OVER 35 YEARS

Sam Gallop CBE volunteered for the Royal Air Force in 1940 as a pilot. In 1944, returning to base in his damaged aircraft, he sustained various injuries resulting in the amputation of both legs below the knee, third degree burns, spinal crush fracture, maxillo-facial injuries, both arms were broken, with left ring finger missing, and partial hearing loss amongst other impairments. Despite Sam's misfortune, his good fortune was that he became a patient of the late Sir Archibald McIndoe at Queen Victoria Hospital in East Grinstead, and I know that he still feels honoured and privileged to have become a member of McIndoe's RAF Medical "Guinea Pig" Club (goo.gl/FWjPW).

After the Second World War, Sam studied at Brasenose College, Oxford, graduating in 1949. He worked from 1949 until his retirement in 1977, then pursuing other interests including charitable work. I could say: *...and the rest is history* but I know from personal experience that a significant number of Sam's achievements are modestly passed over, and are not shouted about. The satisfaction for Sam is in the knowledge of a job well done. So here are just a few examples:

Sam Gallop CBE

- The formation of *Employment Opportunities* now *The Shaw Trust* – a national charity helping people with disabilities find and retain work, whilst providing a wide range of support and advice to employers on disability and employment. This work is supported by the charity's Patron, HRH the Duke of Edinburgh.
- Sam created *Aim Hi*, a charity for hearing-impaired students, linked with schools and colleges in Wandsworth, which also reached out internationally.
- Sam created the *emPOWER* charities consortium.
- He initiated the *All Party Associate Parliamentary Limb Loss Group*, for the prevention of limb loss, and the provision of prosthetic, orthotic, wheelchair and other vital rehabilitation services in the UK and overseas.

Importantly, Sam took it upon himself to become the guardian of the standards and quality for the national prosthetic and orthotic rehabilitation services more than 20 years ago, and today still remains a recognised committed ambassador and a prominent voice for both international and national issues surrounding complex disability, in particular limb loss. Sam's drive, determination and enthusiasm, coupled with his seemingly never ending innovation and creativity, continue to play an important role in the delivery of solutions for often difficult issues.

With age comes experience and wisdom, and Sam has plenty of both. As a widely respected, trusted and inspirational individual, he is often used as a sounding board by many leaders within and across the limb loss communities and service providers of the United Kingdom. Sam uses his network of contacts to instigate discussion which is very quickly followed up by a plan of action. His unstinting and resourceful approach to a problem or issue is unflustered yet dogged, supportive and sympathetic, enthusiastic but diligent. His unselfishness, enthusiasm, determination and energy would put many people half his age to shame. This is even more impressive in that the work he has done, and continues to do, is almost exclusively on issues that he will not benefit from himself.

Sam would want me to add that he could not have achieved what he has without the support of his beloved wife Renée, expert surgical and rehabilitation services, and the many skilled and caring healthcare professionals, friends, tutors and leaders. I hope this article can in some way "celebrate" Sam, particularly given his recent 90th birthday. And so I would finish by saying that I believe such individuals are extremely rare, and it continues to be my privilege to know and collaborate with such a role model and friend!

Steve McNeice (double above knee amputee)

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PMG
POSTURE & MOBILITY GROUP

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EDITORIAL TEAM

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The journal is provided bi-annually to all members of the Posture and Mobility Group. To join, please see www.pmguk.co.uk/members

CONTRIBUTIONS

We welcome submissions from PMG members and others. Please supply your text in a Word (.doc) format, and supply images in EPS, TIFF or JPEG format.

Copy deadline for next issue: **1st March 2013**

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Back Cover:
GB under 22 Harry Brown (who carried Paralympic flag into opening ceremony) with GB team no. 15, Ademola Orogbemi
Photo: BMW, by courtesy of Freud

LONDON 2012 REVISITED

CVE

GENERAL ARTICLES

SCOTLAND

AQP/NCB

EDITORIAL

We're proud to bring you this bumper edition of the journal. From design/development of equipment and research into preventing pressure ulcers to updates on AQP and commissioning, there is bound to be something of interest to all of you. We're very pleased to have some contributions from our colleagues/members north of Hadrian's Wall. If something motivates you to contribute a story about your own work – please don't hold back!!

I hope you will all read the article by members of our Strategy and Policy sub-committee about Improving Wheelchair Services/AQP, as it pertains to all of you. Particularly note the bits in **bold** – these highlight areas and ways in which we can have important influence.

I'm sure you will join me in thanking David Porter for his major contribution over the past seven years as Chair of the Research sub-committee. He was a prime mover in getting the PMG Research Fund up and running back in 2005 and now hands over the reins to the new Chair, David Punt, Reader at Leeds Metropolitan University.

A big thank you to all our contributors, to those on the sub-committee who have helped with planning, editing and other aspects of this issue and, as always, to Olwen Ellis.

Enjoy!

Carolyn

Carolyn Nichols
Editor

NEWS

NATIONAL CLINICAL GUIDELINES FOR STROKE – FOURTH EDITION

The fourth edition of the National Clinical Guidelines for Stroke was published in September 2012. It was prepared by the Royal College of Physicians Intercollegiate Stroke Working Party chaired by Professor Tony Rudd. This working party also oversees the National Audit Programme for Stroke. The fourth edition provides the reader with the most comprehensive coverage of stroke care to date, encompassing the whole of the stroke pathway from acute care through to longer-term rehabilitation. To purchase go to goo.gl/HxZP

PMG RESEARCH SUB-COMMITTEE

In 2013, the maximum grant obtainable through the PMG research fund will be raised from £5,000 to £7,500. www.pmguk.co.uk/pmg-research-funding.html

David Porter who is standing down as chair of PMG Research sub-committee after 7 years.

HOT OFF THE PRESS:

DH *Manual for Prescribed Specialised Services* goo.gl/cDNwO

SPECIAL OFFER FOR PMG MEMBERS

HDTI Posture & Mobility Professional Development Programme Coventry is offering 20% off their course fees to PMG members: goo.gl/9eI2m

Please check your PMG membership status before booking: goo.gl/oex9E

COMMUNITY EQUIPMENT CODE OF PRACTICE SCHEME

aimed at organisations commissioning and providing community equipment, including those with clinical and professional responsibilities. goo.gl/OS5Cl

LETTER FROM THE CHAIR

A warm hello to you all! I can't believe it's been six months since I wrote before, but what a busy time it has been. I'll have to remind myself to keep this short!

The time has seen some interesting developments at the Department of Health in relation to AQP in England, and while invitations to participate in discussions still come with almost impossibly short timescales, we recognise what a major step forward it is for us to be invited – and highlights the significant political influence we have gained. Too much has happened to write here, but of course we will continue to keep you updated through the journal *(see pages 39 to 43)*, website and e-bulletins.

Recently, we attended workshops in Scotland with colleagues from both the Wheelchair Services and Community sectors. These meetings emphasized the depth and breadth of knowledge and expertise amongst our Scottish counterparts, and we look forward to wider sharing in the journal and at NTE.

Oh dear. I'm out of space already, so it just remains for me to thank our Executive Committee members, sub-committee members, and Olwen for their ongoing dedication and hard work. Finally, may I wish you all a very restful Christmas and a peaceful New Year.

With warmest regards,

Clare

Clare Wright
PMG Chair

NEWS

BRITISH SOCIETY OF REHABILITATION MEDICINE

1. Dr Kyaw Nyein, once part of the PMG editorial team, and his fellow BSRM member, Dr John Burn, presented their paper *Management of Complex Neurological Disability in Specialist Nursing Homes* at the Society's June meeting. To download go to goo.gl/xXczh

2. BSRM will be hosting the *4th UK-Dutch Rehabilitation Meeting* in York in April 2013. Details at www.bsrm.co.uk

"BUILDING THE FUTURE" 29TH INTERNATIONAL SEATING SYMPOSIUM

March 5th – 9th 2013
Nashville, Tennessee
goo.gl/gA6jK

THE SOCIETY FOR RESEARCH IN REHABILITATION

SRR Winter 2013 Meeting is in Bath on February 5th.
Details at goo.gl/HD5jL

MARY MASSERY "LINKED: BREATHING AND POSTURAL CONTROL"

Following her success at NTE 2012 *(see Vol 29:1)*, PMG is co-ordinating a return visit to the UK by Mary Massery.

We will keep you updated via the PMG website and ebulletins, but the provisional schedule for 2013 is:
2nd December – London
4th December – Glasgow
6th December – Manchester

GO KIDS GO!

www.go-kids-go.org.uk (formerly the Association of Wheelchair Children) is a national charity whose main aim is to help young wheelchair users become independently mobile.
They also run Awareness Training in mainstream schools and provide courses for health professionals who work with young wheelchair users and their families.

and finally...

Please display the enclosed NTE flyer on your notice board at work.

See you in July!

DEVELOPMENT OF CUSTOM MOULDED SPORTS SEAT FOR WHEELCHAIR BASKETBALL

Phil Swann
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ABSTRACT

This article describes the exciting journey made by Contour886 from providing a moulded thermoplastic seat for a rower in the 2008 Paralympic Games, to provision of a seat for a wheelchair basketball player at the London 2012 Paralympic Games, in partnership with UK Sport, Loughborough University Sports Technology Institute, RGK, and BMW.

INTRODUCTION – BEIJING 2008

Our journey into sports seats began in the lead-up to the Paralympic Games, Beijing 2008. Draft Wheelchairs referred a rower from the coxless pairs to Contour886 to discuss custom moulded seating. I met with James and established that he had a loss of pelvic alignment, a result of an underdeveloped left gluteal muscle. This caused a compensatory lean in his upper body to maintain balance, which increased as his muscles fatigued towards the end of a race. This resulted in changes to James's body symmetry during a race, which was seen to detrimentally affect the balance of the double skull and consequently the rowing technique. The moulded thermoplastic seat made by Contour886 provided key support, as indicated in figure 1.

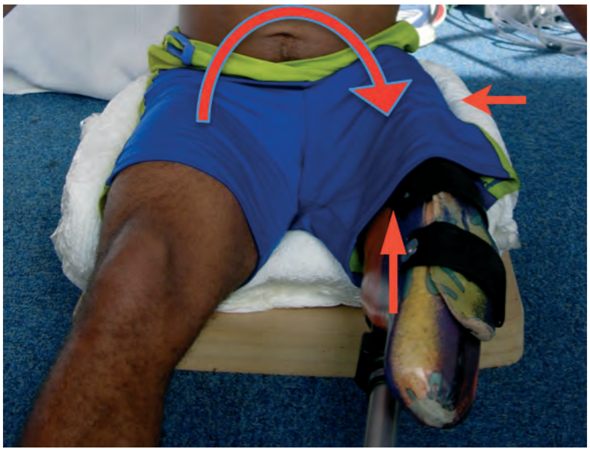

Fig 1. Bead bag mould – yellow force arrows indicate support required to stabilise the red moment causing rotation of pelvis

The seat was successful, with both James and his coach noticing improvements in pelvic stability, upper body balance, and rowing technique. Excited by this positive result and the prospect of London 2012, I was keen to see if any other sports were looking for solutions to postural instability, so I made an approach to UK Sport in Dec 2009.

Unbeknown to me at that time, UK Sport was involved in a project with the design team at Loughborough to review wheelchair basketball and identify areas for performance improvement. UK Sport had commissioned BAE Systems to carry out a human factors review of the athletes, and their views of basketball wheelchairs, in order to identify areas for development that would improve performance in time for the 2012 Paralympic Games. They approached this by splitting the wheelchair into 13 key sub-systems and formulating a comprehensive questionnaire. The results, summarised in figure 2, prioritised the seating system for development.

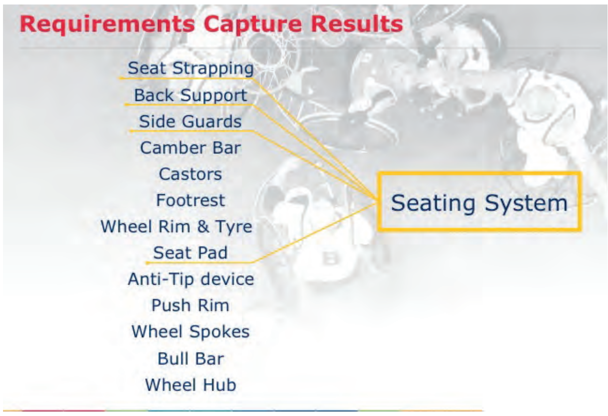

Fig 2. Requirements captured by BAE Systems review

Contour886's involvement in the partnership followed a meeting in January 2011with UK Sport and Loughborough to discuss if our approach to making the rowing seats could be applied to making a seating system for wheelchair basketball. 18 months of intense development work followed, collaborating with UK Sport, Loughborough, RGK, and BMW, to produce sports seats for six men and five women which delivered improvements in support, speed, agility, and comfort.

The remainder of this article focuses on the story for one of these athletes, Ade Orogbemi.

ASSESSMENT AND OBJECTIVES

Ade plays guard and his assessment identified him as a physically powerful player, flinging his chair around the court, and able to flip himself back onto his wheels when he tipped over. Polio as a child left him with paralysis of his right leg and, as a result, he has significantly reduced gluteal and leg mass on the right. When sitting, this asymmetry results in instability of his pelvis as it rotates down on the right, attempting to stabilise onto a surface. Ade compensated for this in his wheelchair with the use of a chip foam wedge under his right buttock and working his right abdominal muscles to maintain a level pelvis.

Ade used two ratchet straps to clamp himself into the wheelchair, one positioned mid-thigh, the other pulling back onto his pelvis at a 45° angle, and he also used a webbing strap wrapped round his knees to keep them together. His feet were positioned under his thighs with knee flexion of about 100°.

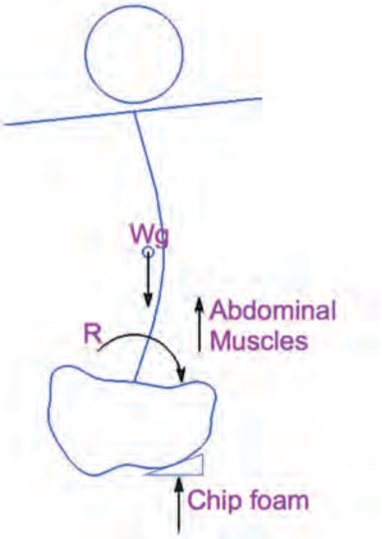

Fig 3. Free body diagram indicating principle forces affecting Ade's posture
R = moment causing rotation of pelvis

A correctable scoliosis in Ade's spine, resulting from poor pelvic support, and the need to maintain balance, was evident. Ade admitted to weaker turning and reach to his right, with an increased risk of tipping on a right turn. Ade was also aware that, during play, he would rotate forward with a shift in his pelvic position to the right.

Fig 4. Ade's existing basketball seating

A physical assessment with Ade standing confirmed that his pelvis was level, with no rotation and some anterior tilt. Ade had full hip flexion with shorter femur and tibia lengths on the right.

POSTURAL OBJECTIVES FOR SEATING:

- Improve pelvic stability in order to:
  - improve upper body alignment and symmetry over the pelvis
  - enable improved reach, left and right
  - improve ability to turn right
- Increase comfort
- Reduce need to constantly adjust seating position

PERFORMANCE OBJECTIVES:

- Maintain wheelchair agility
- Maintain wheelchair speed
- Lightweight seating

THE BEAD BAG MOULDING PROCESS

A basketball wheelchair simulator was designed and made by Contour886 and Loughborough to enable Ade's existing wheelchair configuration to be matched for the purpose of moulding.

The principle forces required to stabilise Ade's pelvis and torso are indicated in figure 5, and table 1 describes how the moulding bags were manipulated to provide that support.

Ade transferred between the existing basketball chair and the simulator so he could provide proprioceptive and other feedback in relation to balance, movement, and propelling technique, thus assessing the

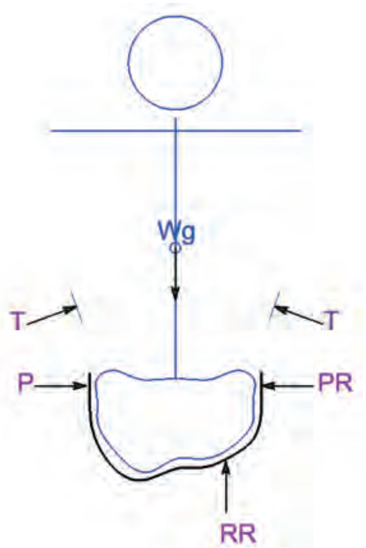

Fig 5. Principle forces to stabilise posture P = pelvic block, PR and RR = support to counter moment R (see Fig 3), T = torso support

effectiveness of the moulded support. Palpation and observation were used to check anatomic symmetry: level pelvis, no rotation, straight spine, level shoulders, and torso balanced over pelvis.

Pelvis	Build up under right buttock to compensate for lack of muscle mass with bi-lateral hip support to counter pelvic rotation down on right. Ischial shaping to discourage slipping forward. Pelvic strap to pull back at 45°.
Thighs	Approximately 10° of ramping with bi-lateral thigh support to maintain hips in adduction and reduce thigh movement during play. Strap to front of seat to pull knees together.
Lower limbs	Foot support position to give 100° knee angle, with a build up under right foot to compensate for a shorter leg length. Foot straps and lateral support to reduce foot movement.
Torso	Sacral support to maintain neutral pelvis. Posterior gluteal asymmetry accommodated to maintain pelvis forward facing. Lumbar support through to lower ribs, with the top rolled out to allow torso extension over the top of the back support. Firm bi-lateral thoracic support pushing in the region of the obliques up to the false ribs. Greater support applied to right side to maintain a straight spine.

Table 1. Description of support profile built into moulding bags

PRODUCTION OF A SPORTS SEAT

A significant factor in meeting the performance objectives was the collaboration between UK Sport, Loughborough, Contour886, and RGK. As a result of this partnership, a methodology was produced to capture critical measures from the moulding process that enabled RGK to build a frame in parallel to production of the custom moulded seat by Contour886, such that Ade's position within the basketball wheelchair frame would be optimal.

Ade's bead bag mould was used to manufacture a forming tool. An evazote inner liner and polypropylene outer shell were thermoformed over this tool to produce a seat. Polypropylene was chosen due to the following material characteristics:

- lightweight
- high tensile strength
- impact resistant
- high compressive strength
- resistant to stress cracking
- retains stiffness and flex

These features were particularly important for the seat to withstand the complex stresses and strains of wheelchair basketball. A spacer cover was upholstered to offer comfort and wick moisture. The thermoformed seat was interfaced successfully to the basketball wheelchair frame and, by July 2011, Ade started a period of testing during training and match play.

It was around this time that BMW, as the Paralympics official sponsor, offered to manufacture a seat using their in-house rapid manufacture expertise. A meeting at BMW's factory in Munich followed to discuss the possibility of using sintering technology. This technique uses digital data, describing a 3D product, to control a laser that fuses powdered material layer upon layer, to build a product. The principle benefit of this process was seen to be the ability to control the design and production engineering process, which could lead to improvements in material performance. A 3D scan of Ade's thermoformed seat (figure 6) was

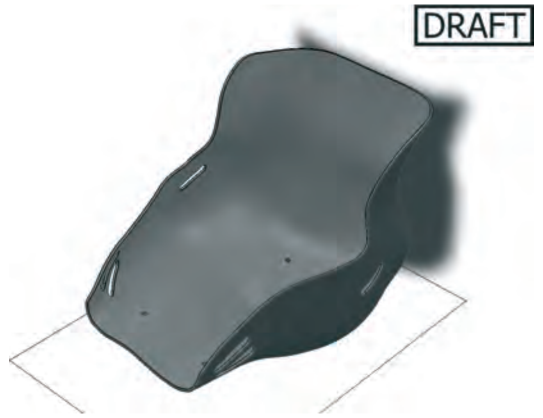

Fig 6. 3D scan of Ade's seat

taken and CAD used to produce the necessary digital data to enable BMW to make a prototype.

BMW produced a sintered seat from this data using a material called DuraForm, which has similar material properties to polypropylene. A second basketball wheelchair was made by RGK in March 2012 and the sintered seat interfaced to it so Ade could trial the new seat (figure 7).


Fig 7. Elite basketball wheelchair and custom sintered seat

OUTCOMES

Subjective and objective outcome measures were used to evaluate the effectiveness of the custom moulded seat for Ade.

OBJECTIVE OUTCOMES:
Sprint and agility tests were used by Loughborough University Sports Technology Institute to measure the performance outcomes. The sprint test measured straight-line speed and acceleration over a 20m run. Ade started from a stationary position with the aim of completing the course in the fastest possible time. The agility test measured multidirectional sprinting performance. Ade had a 5m rolling start before timing commenced, and accelerated for a further 9m before performing a sharp turn (approximately 230˚). Ade then manoeuvered himself back through three more cones in a slalom fashion to complete the course. Performance of the test runs alternated between a right turn at the top cone and a left turn at the top cone to assess manoeuverability evenly.

The mean time taken to complete each test over a series of four to six runs was used to measure performance. The results with the new seat and chair over a six month period for Ade showed:
- Increased speed agility test – time decreased from 10.1s to 9.94s
- Increased speed straight line test – time decreased from 5.11s to 4.97s

SUBJECTIVE OUTCOMES:
Feedback from Ade and his coach were recorded over the period of testing:
- Total confidence turning as quickly to right as left
- Total stability and comfort, no fiddling with bits of foam to get support right
- Reduction in the number of straps required to stabilise position in the seat from three to one
- Decreased time to get back up on wheels when chair tips over
- Increased control righting wheelchair when at the point of tipping over
- Increased control manoeuvring through players, resulting in fewer fouls.

The International Wheelchair Basketball Federation delivered high praise for the project, stating that “the new seat design is a significant step forward in the technical aspects of the wheelchair for the sport. It is an innovative idea and one that has not been seen anywhere in the world before. I’m sure that it will have a huge impact especially amongst the lower point players to have a better seating platform and more control over their chairs.”

Ade Orogbemi said, “the new seat has improved my game enormously from how I was playing in my old chair. The stability it allows me to have now gives me the ability to turn quickly both going right and left which I was unable to do before. The extra speed it gives me around the court makes it easier to defend against the best attacking sides in the world, to give us that unique advantage. I believe it is allowing me to play my best ever basketball, which is not only good for me but for the whole team.”


Fig 8. Ade powering ahead for the basket

There is so much more to report from this project, but I hope this article gives a flavour of the improvements in equipment design and manufacture that benefitted some of the athletes competing in the 2012 basketball Paralympics. This is a great news story for UK innovation where partnership between UK Sport, Loughborough, Contour886, RGK, and BMW has pushed the boundaries of performance seating.

With special thanks to: UK Sport, Loughborough University Sports Technology Institute, RGK, BMW, and BAE Systems.

THE PARALYMPIC GAMES – A DAY OF ATHLETIC EXCELLENCE

Rhiannon Mycock (Winner of *The Last Person Standing* at NTE 2012)
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ABSTRACT

At the end of another successful NTE, I was surprised to hear my name called out as the Last Person Standing – the lucky winner of 4 Paralympic Games day passes, courtesy of Ottobock.

Having visited the Olympic Park twice during the Olympic Games and had a fantastic experience on both occasions, I was intrigued to see how the Paralympic experience would match up. Arriving in the Park in time to hear the roar from the Aquatic Centre as Ellie Symonds broke another world record in her 400m S6 freestyle heat, we knew this was going to be an equally amazing day out, and that the atmosphere would easily rival what we had experienced a few weeks earlier.

Our day pass meant that we could access tennis, basketball, seven-a-side football, and goalball. A check of the schedule revealed that, if we planned well, we could spend most of the day cheering on team GB and get a taste of all the sports on offer.


The thrilling wheelchair basketball match

Our first stop was wheelchair tennis, where we watched Marc McCarroll playing for team GB against number 14 seed Tom Egberink of the Netherlands. After giving a quick lesson to my husband on the effects of wheel camber and axle position, we settled in, and soon were absorbed in the match. The speed with which the match progressed was phenomenal, and only on a few occasions did the allowed second bounce get used. Despite the best efforts and determination of McCarroll, Egberink won in two sets, 6-4, 6-3. The support of the crowd, and the level of interest in the sport, were outstanding; this was highlighted later in the day when we spotted Peter Norfolk in the Olympic Park with a crowd of people eager for autographs.

Our next stop was one of the main highlights of the day for team GB supporters: the women's wheelchair basketball, GB v Brazil. The queue to get into the arena was unprecedented, and we luckily got in just as the national anthems were starting. What followed was a brilliant display of athleticism, speed, skill and tactics – as well as the amazing sight of the players getting themselves and their chairs upright after falls, and the speed of wheel changes for punctures. For the majority of the match everyone in the crowd was kept on the edge of their seats, with the flag waving and cheering at maximum. Both teams used their points system to keep a balance of abilities and skill on the courts at all times. Brazil took an early lead of four at the end of the first quarter but GB kept up the pace to trail only by two come half-time. By the end of the third quarter Brazil led 31-27 and maintained this lead until GB came back in the final minutes to score four baskets and take a four point lead. A final free-throw led to a 42-37 win for GB which was vital for them to progress to the next stage of the competition. They were rewarded by cheers from the crowd and I left the arena having witnessed one of the highlights of all my Olympic and Paralympic viewing.

Continuing with the theme of 2012 hosts v 2016 hosts, we watched the men's seven-a-side football at the Riverbank Arena. In the seven-a-side version of the sport the athletes have neurological impairments, such as cerebral palsy or traumatic brain injury. The players are classified according to their level of impairment, and the team has to be composed of certain numbers from each classification. Brazil was clearly dominant throughout the match, and the final score was 3-0 to Brazil.

Our final sport for the day was goalball in the Copper Box. As we were not able to cheer on team GB, we watched Algeria v China. After hours of cheering for anything and everything, the requirement for utter silence during play made for a change in atmosphere. It was amazing to see how, without sight, the players were able to successfully defend and target using their other senses. There were plenty of attacks and penalty shoots due to high balls, but both teams were so successful in defending that, at the end of the first half, the score was 1-0 to China and this score was held until the end of the game.

After a brilliant day of sport we all left feeling that the Paralympic Games had more than matched up to our Olympic experience. The determination and tenacity of these exceptional athletes created a thrilling day of entertaining live sport for those of us lucky enough to be there.

Marc McCarroll – singles wheelchair tennis

UNIVERSITY OF WEST OF ENGLAND (UWE) AND LONDON 2012

In September 2007, an agreement was signed by Peter Abraham, Lord Mayor of Bristol, and Kip Keino, chair of the Kenyan Olympic Committee, confirming that Bristol would act as hosts to the Kenyan Olympic and Paralympic teams during their pre-games preparations for London 2012.

For a week in the lead-up to the Paralympic Games a squad of 14 Kenyan Paralympic athletes and six guide runners were based in UWE's student village. Delegates at PMG's National Training Event will be staying here in July 2013 – sadly the musicians will have gone.

The spacious bathroom shown is in the adapted accommodation at the student village.

ADAPTING TENSION ADJUSTABLE BACKRESTS FOR WHEELCHAIR USERS WITH CVE

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Marion May
Senior Specialist Seating Therapist
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ABSTRACT

This cross-disciplinary team has developed an easily-deliverable seating solution to promote comfort and lateral support. Used for clients affected by CVE, it allows fitment to the wheelchair without the need for adaptations – such as converting to fixed backrest posts – where modular systems fail to simultaneously maintain lateral control and provide contured support.

Cerebrovascular event (CVE), or cerebrovascular accident (CVA), are medical terms for stroke. A stroke is defined by the World Health Organisation (WHO) as a clinical syndrome characterised by rapidly developing clinical symptoms and/or signs of focal and, at times, global (applied to patients in deep coma and those with subarachnoid haemorrhage) loss of cerebral function, with symptoms lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin (Hatano 1976).

A TIA or transient ischaemic attack (sometimes called a mini stroke) has similar presenting signs and symptoms to a stroke. However, in the case of TIA, these resolve within a 24 hr period. A TIA often acts as a precursor to a stroke and should therefore be taken seriously and reported to a GP as soon as possible

THERE ARE TWO TYPES OF STROKE:

An **ISCHEMIC** stroke is caused by the blood supply to an area of the brain being cut off. This can be either *embolic*, i.e. caused by a clot formed elsewhere in the circulatory system making its way to the brain and blocking a vessel; or *thrombotic*, where blood flow is impaired because of a clot forming in the vessels of the brain itself. This latter type of stroke accounts for 70-80% of all strokes.

A **HEMORRHAGIC** stroke is caused by bleeding within the brain itself (intracerebral haemorrhage), or in or around the membrane surrounding the brain (subarachnoid haemorrhage). This type of stroke occurs when a blood vessel breaks. This may be due to trauma or excessive internal pressure.

Stroke patients may present with a variety of signs and symptoms, including functional loss of ability, cognitive processing difficulties (receptive or expressive), behavioural and visual disturbances. There are often reports of sudden headaches, disturbances of speech, dizziness or loss of balance and co-ordination, with numbness or weakness in the face, hands, arms, or legs especially affecting one side of the body.

In many people who are affected there is often a disturbance or imbalance of tone in the muscles on the affected side of the body compared with the patient's 'normal' non-affected side. This disturbance affects the body's ability to perform functional and bilateral movements, having a major impact on postural control in sitting and standing, and can affect midline awareness and body image.

Seating and 24-hour positioning are primary considerations for all those involved with rehabilitation of stroke affected patients, and those with other ongoing neurological

Fig. 1

disturbances. For these patients to recover their optimum potential of function and movement, and to prevent the occurrence of deformities and contractures, midline awareness and normal movement patterns need to be encouraged and reinforced.

When training external therapists to assess, or when assessing for and providing stroke patients' mobility equipment, our seating team would often use the Qbitus Backbrau and wedges (Fig. 1). These, in conjunction with Qbitus armpads and a contoured pressure cushion, make an easy-to-use and manage first point-of-call seating system for patients, promoting and maintaining midline awareness and symmetrical positioning.

However we had concerns regarding the use of this type of proprietary equipment. Often we found that the Qbitus wedges were too big and bulky for patients, pushing them forward from the back canvas, thus losing seat depth in the chair. We also noticed that the firm back of the Backbrau – which for some clients promoted improved tonal control – did not allow for accommodation of the premorbid postural deformities which often exist in the more elderly population.

Fig. 2

For these clients with a more compromised seated position it was necessary to create something which would allow accommodation of the primarily kyphotic postures and yet still offer some lateral control. This would help prevent the tonal trunk asymmetry which is often the outcome of a stroke and can cause a positional scoliosis if it becomes fixed.

We decided that the best way these clients could be supported was to use a tensionable backrest (Fig. 2) – originally the Xtasy Backrest, an accessory designed, named, and sold by Exeter Industrial Services (now Pluss). This has five 50mm webbing belts stitched to an inner assembly which fits over the backposts. The belts are secured and adjusted with velcro and a tri-glide covered with a padded throw. This version had piping on each side of the front surface (no picture).

Fig. 3

We first adapted this by adding velcro loops to the front of the throw to allow the use of Backbrau wedges. Initially this gave some better results, allowing an accommodative shape with laterals. But the Backbrau wedges were still too intrusive.

We therefore decided to integrate a form of lateral support by designing slimmer triangular wedges to be attached by velcro under the backrest throw on either side of the backrest, thus utilizing the backpost canes as vertical supports (Fig. 3). The laterals were positioned to be set approximately 25-50mm below the axilla and to go down to 50-75mm below the armrests. This positioning then allowed the laterals to withstand the side loads without moving. These are far less obtrusive and almost hidden from view (Fig. 4).

Fig. 4

A need for modification to this system occurred when we encountered clients who would benefit from a wider chair – often necessary with modular seating – but whose environment posed obstacles such as narrow doorways which prevented the supplying of a wider chair. A problem which many of these clients encounter is that the chair's metal back posts impinge on their back and shoulders, often causing discomfort and, in some cases, pressure problems.

We decided to elongate the top section of the tensionable back throw to form two wraparound wings which we used to cover and pad the backpost canes (Figs. 5 & 6). By incorporating this padding into the shape of the backrest itself we were able to use the backposts of the chair as a lateral control, giving a broader area of contact and allowing the use of the narrower chair where the wider one would have initially been the clinical option of choice.

Fig. 5

As a further modification we've created bespoke designs:

- We can vary the length and width settings of the straps in the tensionable back to allow increased contouring.
- We are able to pad the front of the straps with memory foam (attached by velcro) to accommodate hyperlordotic postures or to promote a lumbar lordosis or sacral block if required.
- We can add different grades and thicknesses of foam to the throw, including viscose type memory foam where a client's spinous processes are prominent and tissue is vulnerable.

Fig. 6

An added benefit of using this system of seating is that patients have increased autonomy; for comfort they are able to ask their carers to alter the postural control slightly if required by varying the tension on the straps in the backrest, or to open up the hip angle to promote a recline in the seating if they become tired when seated.

The development and redesign of the Xtasy back has allowed a flexible system of support which can be easily fitted by approved repairers, although our experience shows initial adjustment is best done by the prescribing therapist or rehabilitation engineer. Where contouring is required, the clinical outcome achieved with this redesign can exceed the outcome obtainable with proprietary modular backrest supports. In addition, it is user-friendly, easily adjustable, and cost-effective.

DRIVING TO LEARN: A NEW INTERVENTION FOR PEOPLE WITH STROKE AND SPATIAL NEGLECT

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ABSTRACT

This paper describes a pilot study aimed at exploring the effects of using the *Driving to Learn* method in the sub-acute phase after stroke with spatial neglect. Five participants, aged 40-82 years, 10 days to 10 months post stroke with right hemisphere lesions and spatial neglect, did one test trial in a TIRO, a special powered wheelchair for people with cognitive disabilities. The trials applied principles for practice that were found to be appropriate for people with stroke and spatial neglect during the *Driving to Learn* project. All five participants obtained remarkably increased levels of alertness and ability to sustain attention during the trial. In three of them the observable signs of spatial neglect in forward navigation tasks had disappeared after a trial of 40 to 60 minutes.

BACKGROUND

Even though there is research pointing out the benefits of powered mobility for people with stroke, very few of them are provided with a powered wheelchair on discharge from rehabilitation centres (Mountain et al, 2010a & 2010b). Provision of powered mobility devices is directed by considerations about how limitations in perception, cognition, visual attention, and executive function may influence the ability to operate a powered wheelchair securely and skilfully (Turton et al, 2009; Mountain et al, 2010b). However, clinical guidelines give no clear recommendations on the choice of interventions (Ting et al, 2011). In stroke rehabilitation it is well known that the persistence of spatial neglect and cognitive impairment is a negative indicator for recovery (Parton & Husain, 2004; Cumming et al, 2009; Ting et al, 2011).

During a previous project named *Driving to Learn*, a special powered wheelchair was developed which had characteristics appropriate for users with cognitive limitations and attention deficits, and it was equipped with a ‘one-for-all’ seating unit that could quickly be adjusted from child to adult size without using any hand tools (Nilsson & Eklund, 2006). The project studied what could be achieved if children and adults with profound cognitive disabilities got the opportunity to practice in a powered wheelchair (Nilsson & Nyberg, 2003; Nilsson, 2007). In addition to the target group of 45 participants with profound cognitive disabilities, two reference groups – one with 17 typically developing infants and another with 64 participants with other degrees of cognitive disabilities – were engaged for comparison of indicators of achievements (Nilsson et al, 2011). During the project, it was observed that in three participants with stroke and spatial neglect (two men and a woman, aged 63 to 86 years) who were included in the latter reference group, their neglect symptoms faded away in just a few sessions. These promising findings initiated the pilot study described in this paper.

AIM OF STUDY

The aim of this pilot study was to explore the effects of using the method *Driving to Learn* in a special powered wheelchair in the sub-acute phase after stroke with spatial neglect.

LITERATURE REVIEW

SPATIAL NEGLECT

The term spatial neglect is interchangeably used with visual neglect, hemispatial neglect, unilateral neglect, and visual inattention, and it is characterised by a failure to report, orient to, or respond to events in the contralesional hemispace (Ting et al, 2011; Cumming et al, 2009). Right hemisphere lesions more often lead to severe and enduring neglect than lesions in the left hemisphere (Parton et al, 2004). Many patients with stroke are unaware of their spatial neglect and are thus not able to consciously modify their behaviour by turning their gaze towards the neglected hemispace (Parton et al, 2004; Ting et al, 2011).

INTERVENTIONS

Existing interventions aim to utilise remaining brain function (compensation), adaptation or environmental modification (substitution), or retraining of the brain function (restitution) (Ting et al, 2011). Trials with prism adaptation and virtual reality have been promising but are not yet recommended interventions for clinical practice (Parton et al, 2004; Ting et al, 2011).

NEUROPLASTICITY

The adult brain has the ability to reorganize and reconstruct after an injury (Kolb & Campbell Teskey, 2010; Ting et al, 2011). Complex environments and experiences can affect the synaptic organisation in the brain, and the modification of the neural networks underlying behaviours is reflected by changes in spine density and dendritic length; when there are indications of learning, there must have been a change in the neural networks responsible for the learning; conversely, for behaviour to change there must be a neurological change (Kolb & Campbell Teskey, 2010). However, the difference, and therefore the challenge, in rehabilitation of an adult with brain injury compared to a child is to modify neural networks already shaped and stable after a lifetime of experiences. The adult brain also has some natural system preventing neural generation, as new cells would disrupt the experienced neural network underlying perception, memory, and behaviour (Kolb & Campbell Teskey, 2010).

ATTENTIONAL NETWORKS

Attentional processes like orienting, alerting, and executive control interact in the preparation of quick and accurate responses to incoming information by selecting relevant, and ignoring irrelevant, stimuli (Chica et al, 2012). Visual attention is controlled by both cognition(top-down factors such as knowledge, expectations, and goals) and bottom-up factors reflecting sensory stimulation. Patients with spatial neglect have deficits in searching, detecting, and reorienting (shifting attention) to behaviourally relevant stimuli outside the focus of actual processing, rather than in top-down goal-directed orienting (Corbetta and Shulman, 2002; Posner, 2012). There are studies showing that persistence of neglect is predicted by the degree of impairment of sustained attention, and that alertness training can improve spatial deficits (Parton et al, 2004; Chica et al, 2012).


Fig 1. Gällivare Hospital

SPATIAL NEGLECT AND LEARNING POWERED WHEELCHAIR USE

It is a well-known phenomenon that people with spatial neglect veer to one side when driving a wheelchair; there is less known about how to intervene to reduce this consequence of the neglect (Turton, 2009). A study by Mountain et al (2010) found that many people with stroke, also with spatial neglect, could learn to operate powered wheelchairs in a safe and skilled manner. All 10 participants in their study made improvements within only 2.5 hours of appropriate training.

METHODS

The pilot study was the first part of an implementation study of the new intervention, *Driving to Learn*, carried out at a unit with medical and stroke rehabilitation facilities at Gällivare Hospital (Fig. 1) in the northern part of Sweden. In agreement with the occupational therapists at the unit, a convenience sample was recruited for the pilot trials. The five engaged participants, aged from 40 to 82 years, had their stroke 10 days, 21 days, 2 months, 2.5 months, and 10 months before their trial in a powered wheelchair, and they all had a right-sided hemispheric lesion.

POWERED WHEELCHAIR

TIRO (Fig. 2), the powered wheelchair specially designed for practice with people with cognitive disabilities (Permobil, leaflet), was used for the trials. It has a 'one-for-all' seating unit which can be easily adapted to people of different sizes. The joystick is mounted in the middle of a Plexiglas tray mounted on the armrests; this placement not only allows for both right- and left-hand operation, it also means that the operating tool is in the midline of the visual field. The seating unit provides a stable upright working position with the tray supporting both forearms, which impacts on trunk, neck, and head stability. The electronics are specially programmed to provide immediate response and to make it possible to drive

Fig 2. TIRO

very slowly with low torque, allowing safer collisions. The chair is also equipped with a mechanical bumper to protect legs and feet, and the environment.

PRACTICE OF DRIVING TO LEARN

Initially each participant had time to relate to the trial leader (LN) and to recognise and test the functions of the powered wheelchair. This took place in a large combined kitchen and living room (Fig. 3), with space to explore what happened when the joystick was pulled or pushed in different directions. A test of driving into things at the lowest speed was made to reduce anxiety and get the bodily experience of a collision. Testing also included driving a couple of decimetres forward or backward and stopping on instruction.

After the introduction the participants were observed when driving a route around the ward, navigating straight along corridors, passing doorways, being distracted by noise and unexpected events, meeting people, making turns to the left and to the right. Based on interpretation of the observations, an individually adapted practice followed for each of the participants.

MAIN PRINCIPLES FOR PRACTICE:

- Start at low speed and increase speed in agreement with the participant; or ask what speed the participant wants for a specific task.
- Begin with tasks at a simple level and go to increasingly more complex task levels.
- Regularly shift between forward and backward driving, leftward-rightward turning, and clockwise/counter-clockwise circling.
- Allow veering, collisions, and other low-risk incidents, but stop the driving immediately at an incident and start a dialogue, giving feedback to facilitate the participant's reflection about what took place by asking questions like: "What happened?" "Why did it happen?" "How can you avoid it happening again?"
- After every dialogue, agree on which speed and level of complexity to go on with; or give time for a short stand-still in the powered wheelchair before proceeding with practice; or set the speed lower and select a simpler task.
- Adjust speed and tasks to provide the 'just-right' challenge for the participant.
- Encourage the participant to present own ideas on appropriate, more fun, or more difficult tasks, if possible building the session up using collaboration and dialogue.

EXAMPLES OF TASKS

- Shifting between driving forward and driving backward, for longer distances in a corridor.
- Driving around corridor corners towards the left and towards the right; and through doorways.
- Driving in a circle round a big rectangular table in the kitchen with plenty of space around it; or navigating in a circle round a billiard table in a training room with little space around it, making the navigation more difficult.

An example of increasing the level of complexity with particular regard to spatial neglect:

1. Driving forward in circles clockwise, with the table to the participant's right, in the ipsilesional visual field.
2. Driving forward in circles counter-clockwise, with the table to the participant's left, in the contralesional visual field.
3. Driving backward counter-clockwise, with the table to the right in the direction of movement (in the ipsilesional visual field).
4. Driving backward clockwise, with the table to the left in the direction of movement (in the contralesional visual field).

Fig. 3 Relating and testing area

MEASUREMENT AND FIELD NOTES

The instrument for assessment of the process of learning joystick use developed during the *Driving to Learn* project (Nilsson et al, 2011) was used during this pilot project to measure powered wheelchair use at the start and end of a session. This instrument assesses eight phases of learning in each of the following eight categories: activity form, behaviour and activity, hand and arm movement, consciousness of joystick use, alertness, motive, driving style, and expression. To illustrate, the phases of learning in the category of driving style are:
1. Guided or accidental; 2. Keep on driving after release of guidance; 3. Self-initiated voluntary; 4. Intentional, intended, destined; 5. Experimental, explorative; 6. Goal-directed but unskilled; 7. Mastery of steering; and 8. Secure, skilled navigation.

Each trial was observed by two or more occupational or physical therapists acquainted with the participant, and field notes were taken on their commentaries regarding actual performance compared to previous treatment and recovery of spatial neglect.

RESULTS/FINDINGS

A general finding of the trials was that all five participants showed a remarkably increased alertness and ability to sustain attention compared to what they revealed in other interventions and activities.

Three participants (21 days, 2 months, and 10 months post stroke, aged 40 to 72 years) in 40 to 60 minutes stopped veering to the left while driving forwards in a corridor; managed taking both right and left turns without coming too close to the corner; took a centred position while driving through doorways; and managed to drive around a rectangular table both clockwise and counter-clockwise without colliding with the furniture. Measurement at start of the session: 4-5; at end: 6-7; alertness and attention increased rapidly but fluctuated with tasks' level of complexity; initially stops were needed to re-establish sustained attention but, at the end, attention had become more stable.

One participant (10 days post a second stroke, aged 80 years) in 60 minutes went from not being able to cooperate in transfer, not interacting and keeping eyes shut, not understanding the function of the joystick, to becoming alert, cooperative, responding to communication, and driving the powered wheelchair forward around a table. Measurement at start of session: 2; at end: 5-6. Alertness and attention increased continually over the session.

One participant (2.5 months post stroke, aged 82 years) had a most severe spatial neglect with additional sensory and cognitive deficits, and at rest held his head stiffly turned to the right. In 30 minutes he went from being uncooperative and not understanding the function of the joystick to trying to make the wheelchair move in a forward direction in the corridor, holding his head in a straight/forward position. However, he did not turn his head across the mid-line more than twice; this was during a dialogue after colliding into the left wall of a corridor. Measurement at start of session: 2; at end: 3-4. Alertness rose markedly but he got tired quite quickly.

It was noted that all the occupational and physical therapists commented in the field notes that the participants had not showed this level of alertness and attention in any other activity.

DISCUSSION

The findings from this pilot study are encouraging, as three out of five participants in one trial of 40 to 60 minutes made a shift from neglecting information from the contralesional hemispace to increased attention to both visual fields. This indicates that the new intervention, *Driving to Learn*, might be beneficial for people with stroke and spatial neglect.

Explanations for the positive findings may be related to the nature of powered wheelchair use, which is 'multitasking in motion' - it is an activity that requires alertness and sustained attention, activates sensory-motor functions, and involves mobility in interaction with objects, people, and environment. Therefore the intervention involved factors affecting synaptic organisation such as complex environments, sensory and motor experience, task learning, and play (Kolb and Campbell Teskey, 2010). Also, the use of specific tasks targeting the visual attention deficit and instant dialogic feedback to signs of neglect may have enhanced the outcome.

The intervention generally started at a simple, undemanding level of powered mobility use at low speed, and increasingly moved to more complex, demanding levels at higher speed. At every moment of a session, the level of demand was adapted to user reactions and performance. The intervention was also characterised by frequent shifts between speed setting, directions, turns and tasks. Shifting in between task sets is effortful and demands attention (Corbetta and Shulman, 2002). Thus speed and the performance of tool use in an increasingly complex environment may have influence on the increased ability to sustain attention but also to shift focus of attention. The safe collisions (which are an important bottom-up influence) and the instant dialogic feedback (which is an important top-down influence) were directing attention to behaviourally relevant information in both visual fields (Corbetta and Shulman, 2002; Posner, 2012), thereby facilitating reflections, increasing self-awareness, and enhancing executive control (Ting et al, 2011).

The findings of this pilot study are in line with the positive findings of Mountain et al (2010b) who also found that, with the use of appropriate tasks for training, people with stroke and spatial neglect could learn to use a powered wheelchair.

However, the findings should be interpreted with caution as this is a pilot study with few participants, and the findings may depend on each of the studied participant's cause of deficits, spatial neglect severity, any combination of additional impairments, and the length of time passed post-stroke. Stroke with spatial neglect is a heterogeneous phenomenon with individual presentation of deficits depending on the site of lesion in the brain (Parton et al, 2004; Ting et al, 2011). Also age influences the possibility of recovery and neural re-organization (Kolb and Campbell Teskey, 2010).

CONCLUSIONS

In stroke patients with spatial neglect, taking part in appropriately planned sessions of powered wheelchair use may rapidly improve alertness and ability to sustain and shift attention between relevant locations of interest in both visual fields. A larger study is needed to confirm the encouraging findings and to explore if the effects are long- lasting, and if they influence activities in daily living and independence.

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WHEELCHAIR NAVIGATION AND UNILATERAL NEGLECT: CAN THE USE OF TECHNOLOGY IMPROVE PERFORMANCE?

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Following stroke, the deficit of unilateral neglect (also referred to as *spatial neglect, hemi-inattention* and *the neglect syndrome*, amongst other terms) is associated with poor outcome with affected patients relatively unlikely to relearn to walk (Buxbaum et al., 2004). The outlook for regaining independent mobility is made still worse by the general inability of patients with unilateral neglect to effectively use a power chair, a device that is known to have a profoundly positive impact on the quality of life of disabled individuals (Davies et al., 2003; Woods & Watson, 2003). Indeed, the presence of unilateral neglect normally excludes individuals from even accessing assessment for a power chair (Frank et al., 2000).

Defined as an inability to report, respond or orient to stimuli presented on the side of space opposite a brain lesion (Heilman et al., 1985), patients with unilateral neglect are typically unaware (or less aware) of events taking place on one side (the contralesional side) of space. Studies have confirmed the clinical observation that affected patients tend to bump into obstacles on this side when navigating around their environment (Webster et al., 1989; Punt et al., 2008).

It is known that some patients will improve their ability to use a power chair with practice early after stroke (Dawson & Thornton, 2003; Mountain et al., 2010). Furthermore, interventions have been developed to improve the skills of affected patients in the more chronic stages (Punt et al., 2011; Jacquin-Court et al., 2008). However, it remains the case that the vast majority of affected patients will not access powered mobility, and those who do will normally be found to be unsafe navigating around their environment.

The development of new technology may offer the prospect of improving access to powered mobility for patients with unilateral neglect. Around the world, numerous groups have developed ‘smart’ technology for power chairs (see Simpson, 2005 for a review) but an effective and affordable solution for patients with unilateral neglect remains elusive.

We recently tested the navigational skills of nine patients with unilateral neglect on an obstacle course in a rehabilitation centre. We also assessed the impact of a collision-avoidance system (known as the *Anti-Bump System* or ABS) on these same patients. The ABS was developed a number of years ago by the Special Controls Service – part of the Posture and Mobility Service at the West Midlands Rehabilitation Centre – and supplied with some success to a child with cerebral palsy who displayed general inattention to his surroundings whilst driving his chair. The system allows normal use of a power chair via joystick control. However, a series of infra-red sensors mounted on the chair (see Fig. 1) can be triggered when an obstacle is in close proximity and, through communication with the control system of the chair, momentarily turns the chair away from the obstacle, the chair then returning to normal joystick control by the user. As such, the system appeared to have particular utility to improve performance for patients with unilateral neglect.

Our tests revealed some promising results. Patient performance on the obstacle course was measured by counting the number and side of errors. In addition, and in common with an earlier study investigating wheelchair navigation (Webster et al., 1989), we separated errors into ‘direct hits’ (i.e. head-on collisions where the front of the chair collided with an

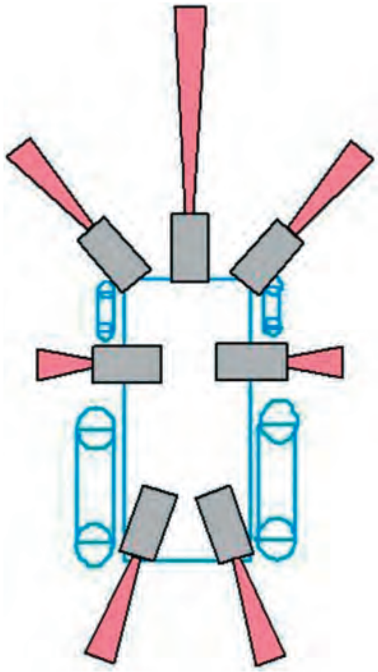

Fig. 1

obstacle) and 'side swipes' (i.e. where an obstacle was avoided by the front of the chair but was still disturbed by a more posterior part of the chair).

Across the nine patients tested, there were fewer errors when the ABS was active (0.36 per trial) than when it was inactive (0.42 per trial). For errors on the 'affected' side, direct hits were more noticeably reduced when the ABS was active (0.16 per trial) compared with when it was inactive (0.65 per trial). However, side swipes on the affected side **increased** at the same time (inactive = 0.74 per trial; active = 0.97 per trial). None of these differences were statistically significant. The data are shown in Fig. 2.

Our findings were perhaps less clear due to variation in navigation ability across the sample. A number of patients had very mild problems and performed well under control conditions, leaving little room for improvement under ABS conditions. For the two patients who had more marked difficulties, the ABS had a more dramatic effect, reducing direct hits more markedly than the group data suggest (1.2 to 0.4 and 1.3 to 0.3 per trial for these cases).

However, a reduction in direct hits for these patients was accompanied by an increase in side swipes (0.8 to 1.0 and 0.9 to 1.6). In some cases, side swipes were due to the chair avoiding a collision (due to ABS activation) on one side, only to generate a side swipe on the other. While, on balance, one would conclude that performance was improved by the ABS, these problems highlight the current weaknesses of the system, and inform challenges for the future with regards to further development.

It is difficult to know how these results might translate into real world improvements for patients using the ABS within their normal environment. We deliberately created a challenging course with some very narrow gaps and tight turns. In all probability, many environments would not provide the same degree of challenge with regards to these aspects. However, a very careful assessment of the environment within which the ABS is intended to operate would be essential to minimise risk.

For patients with unilateral neglect, encouraging them to have primary control of the power chair seems appropriate. Patients typically have some degree of hemiparesis but, due to the right brain damage bias typical in the neglect population, more often than not patients have relatively good use of their dominant limb and can easily manage a normal joystick control. However, while they can generally plan a broadly appropriate route and steer in the overall intended direction, their tendency to collide with obstacles (particularly on their neglected side) means that some

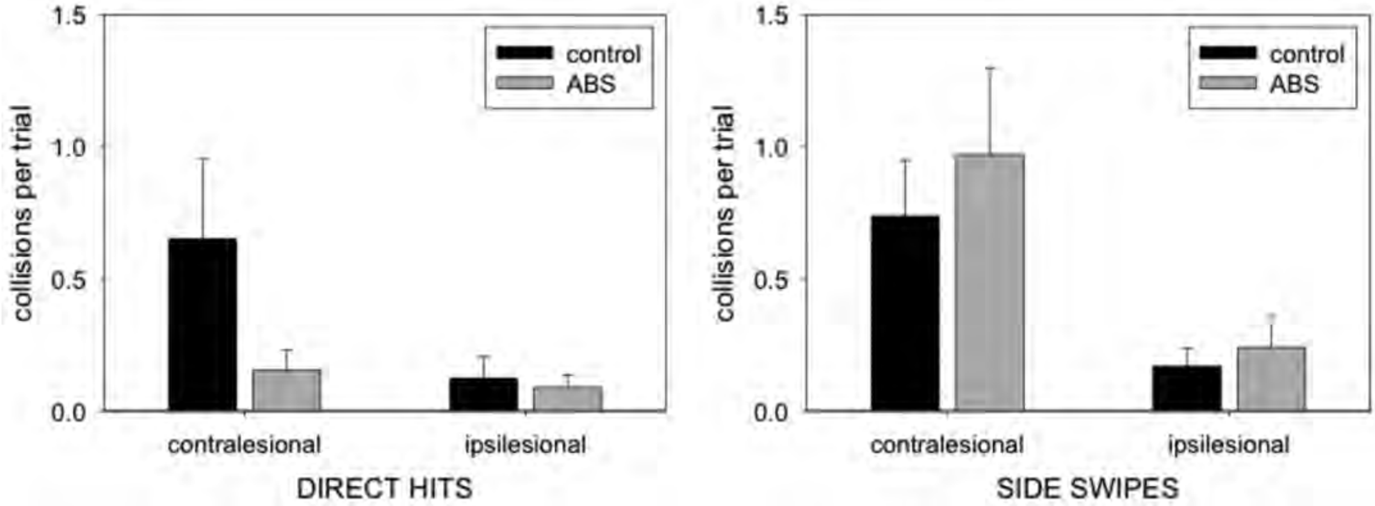

Fig. 2

form of collision-avoidance would be required. To some extent, the ABS can provide this secondary control and together one might consider the chair to be operated under ‘shared’ control, an approach that is now being recognised by other groups as optimal in the development of technology to provide greater access to powered mobility (Carlson & Demiris, 2008).

Participants were generally unaware in terms of their knowledge of when the ABS was active or not, and this is reassuring with regards to its potential utility. The aim of the ABS is not to become too imposing on the user’s experience as an active driver. The responses of participants appear to suggest that deviations in their trajectory when the ABS was activated are not sufficient to either be noticed or to be a distraction. In terms of usability, this is optimal, but one may want to adapt the ABS to prompt patients when the system is activated, for example by providing a sensory signal or cue (e.g. an auditory tone). Potentially, using the ABS in rehabilitation as part of a training wheelchair, with auditory or other sensory signals, would build on evidence from studies that have shown that spatial cues help to shift patients' attention to their neglected side (Riddoch & Humphreys, 1983). Having a patient train to use a powered chair fitted with the ABS within a controlled environment, and with these modifications, could be an effective training strategy, and might negate the requirement for a therapist to supervise training sessions, as is currently the case.

For a collision-avoidance system to demonstrate optimal utility, one might expect it to allow the user to avoid collisions altogether. In our tests, this was clearly not the case, and user environments may well be more challenging (in numerous ways) in comparison to our obstacle course. Limitations of the ABS include its inability to reliably detect obstacles, a problem which includes difficulties in both consistently detecting obstacles when they are a given distance from the sensor, and also ‘coverage’ around the chair. The infra-red sensors employed by the ABS may have an inherent weakness in this regard and may be more problematic in complex environments. While increasing the number of sensors may eliminate the occasional blind spot we encountered, the difficulty in consistent response is likely to remain. Developing the ABS using a higher specification of sensor (e.g. sonar) may improve this issue, though these are not without their difficulties (Dutta & Fernie, 2005). Sensors with a higher specification would also increase costs.

Even with development, the ABS would require the user to operate it within a relatively controlled environment. However, one could imagine an effective collision-avoidance system enabling users to benefit from powered mobility in environments such as care homes and their own homes, where one could impose some constraints on potential hazards. Safety issues for the user and other residents would be of primary concern (Mortenson et al., 2005) and collision-avoidance capability is likely to be one contribution to a broader approach to enablement that would be required for powered mobility to become more common in these environments (Dutta et al., 2011).

In summary, our study has demonstrated the feasibility and potential benefits of the ABS in a relatively well-defined group of patients who are currently denied access to powered mobility. However, technological limitations require further developmental work and it is likely that technology is one of numerous components that need addressing if more patients are to gain access to powered mobility. Importantly, the need for engineers, clinicians and users to work together in this endeavour is essential.

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DEVELOPMENT OF WEBSITE FOR STROKE CARERS

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ABSTRACT

Stroke4carers is a free online resource for unpaid stroke carers, families and friends of anyone affected by stroke illness. **www.stroke4carers.org**
The website aims to give practical advice, information and support to stroke carers whenever they need it. The site uses interactive graphics, quizzes, animations, and film clips to illustrate some of the more difficult to understand concepts. It was developed in partnership with Chest Heart & Stroke Scotland, NHS Scotland, The University of Edinburgh Learning Technology Section, and the Big Lottery Fund Scotland.

STARS AND BEYOND

From May 2010 the project coordinator was seconded from an occupational therapist post with NHS Lothian to develop the stroke carer website. *stroke4carers* is an addition to the STARS (Stroke Training and Awareness Resource). **www.stroketraining.org**

STARs
www.StrokeTraining.org
STROKE TRAINING & AWARENESS RESOURCES

This free online learning tool is aimed at training for paid health and social care workers. Launched in 2008 STARS has basic core competencies training for all staff working with stroke patients, and 10 advancing modules for more highly trained or skilled stroke staff. A further five advanced modules will be available from December 2012.

There is also a module about thrombolysis treatment which medical and nursing staff in acute medicine are encouraged to complete. All the modules are researched, developed, and edited by stroke clinicians, such as nursing, medical and allied health professionals, to ensure best practice is included in the scenarios for each module.

STARS gives equity of learning for staff wherever they are working, and the core competencies training has become accepted as the clinical standard of training required for staff to work in acute Scottish stroke units.

A review by Chest Heart & Stroke Scotland stroke liaison nurses in 2009 found that many stroke carers were looking for information and practical help after discharge from hospital. Many said they did receive information via booklets and leaflets while the person was in hospital. The person's condition after the stroke was changing over time, when most of the information was given. Many carers could not take in information they had been given, or they were not ready or able to understand the implications for themselves and their loved one. Many did not even consider themselves to be "carers" until much later, after the person had been discharged. It became apparent that families were thrust into the world of stroke just as suddenly, and with as big an impact, as the person who has had a stroke. This was backed up by information from the Chest Heart & Stroke Scotland Advice Line nurses. About a quarter of the total calls they receive are from carers and family members.

The Scottish Intercollegiate Guidelines Network (SIGN) 118, Management of patients with stroke: Rehabilitation, prevention and management of complications and discharge planning states that patients and carers require information at regular intervals and in different formats.

WHAT DO STROKE CARERS WANT?

A consultation process to discover what needs carers themselves identified took place between June and September 2010. Our aim was to contact as many stroke carers as possible, with different levels of carer experience, in urban and rural locations. This was done in three ways:
1. Two stroke carer focus groups in Edinburgh and Paisley
2. Interviews with newly diagnosed patients and their carers at a TIA (Transient Ischaemic

Attack) out-patient clinic in Aberdeen
3. Phone and email questionnaires to stroke carers in remote and rural areas of Scotland who wished to take part but could not leave the person they care for.

There were some common themes which emerged from the consultation process:
- Carers wanted to know how they could help the person to recover
- They asked for better two-way communication with healthcare professionals
- More practical information about what to expect when the person comes home from hospital
- Although they know the person best, they often felt their views and knowledge were overlooked or ignored
- They asked how to get help for themselves when they need it
- Where could they turn to?

A total of 55 carers gave 70 ideas of what they would like to have known more about. Some included topics which they still needed advice about months or years later, as the person's condition changed, from applying for a blue badge to respite care to return to work issues. Their experience as carers ranged from a few days post TIA to ten years after stroke.

A final seven topics were chosen:
1. Stroke cause and effects
2. The hospital team
3. Practical advice and tips for carers
4. At home
5. Money, benefits and legal issues
6. Support for you the carer
7. Carers' rights

The project also had an active steering group which included three stroke carers, one of whom took part via video conference from Wick in the north of Scotland. Other group members came from Chest Heart & Stroke Scotland, carer organisations in Edinburgh and the Borders region, the chair of the NHS National Advisory Committee for Stroke, and University of Edinburgh Learning Technology staff.

During the development of the website, clinicians were involved in contributing and reviewing sub-topics. A combination of many nurses, physiotherapists, occupational therapists, psychologists, dieticians, and speech & language therapists gave their knowledge and expertise. There was a genuine desire to assist stroke carers from all the professionals involved. Some of the sub-topics required specific knowledge from carer organisations,

hospital chaplains, social work in both hospital and community, and Citizens Advice Scotland.

Part of the funding for the website was specifically to produce practical film clips with lots of tips and advice which stroke carers could watch at home. In total, 34 clips were filmed. All the film clips are downloadable to share with carers who may not have access to the internet. To date around 11% of the users have accessed the website from mobile devices such as phones or tablets. Many of the pages of tips can be downloaded or printed. The website has links to other sources of information, including other organisations, documents and websites, for further help if required.

SECTIONS RELEVANT TO POSTURE AND MOVEMENT

The following sections within topic 3, *Practical advice and tips for carers* on the *stroke4carers* website may be of interest to readers:

PHYSICAL DEFICITS

This section includes care of the affected arm, positioning a stroke patient in a chair or bed, balance and mobility issues, walking with an ankle foot orthosis, falls and falls prevention, how to assist someone after a fall.

MOVING AND HANDLING

This section has advice about using turning aids, glide sheets and sliding boards. It also shows how to manoeuvre a wheelchair and assist the person in and out of a car safely.

EQUIPMENT

Manual and powered wheelchairs, bathing equipment, hoists and chairs are shown and explained briefly in this section. It also has a page about disabled living centres in Scotland.

DRIVING AND TRANSPORT ALTERNATIVES

This includes a page about adaptations to cars which may be suitable for stroke patients, and driving assessments.

THE STORY SO FAR

The stroke4carers website was officially launched at the UK Stroke Forum in November 2011. In its first year the site has had over 30,000 hits from over 26,000 individual users in 148 countries. Around half of those using the website are from the UK. The website has also been used by health and social care professionals for teaching and to understand the issues and roles undertaken by stroke carers. The evaluation of the website will be completed in May 2013.

As a clinician, the *stroke4carers* project gave me a unique opportunity to use my stroke knowledge in a totally new way, working outside the NHS within a very supportive and enthusiastic team from the voluntary sector at Chest Heart & Stroke Scotland.

A MULTIDISCIPLINARY APPROACH TO PREVENTING SEATING ACQUIRED PRESSURE ULCERS

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INTRODUCTION

In 2011 the Faculty of Health Sciences at the University of Southampton appointed Dan Bader as Professor of Bioengineering and Tissue Health; his task was to create a new multidisciplinary team (MDT) focused on maintaining skin health and preventing pressure ulcers. The team currently includes a research fellow (Peter Worsley, physiotherapist), a senior nurse from the Netherlands (Lisette Schoonhoven, also a current Trustee of the European Pressure Ulcer Advisory Panel), and three PhD students with backgrounds in hospital/ community nursing and physiology. These researchers complement existing academics with expertise in physiological monitoring and continence technologies. The research group is based at the University Hospital Trust in Southampton where a new clinical academic facility has been created to provide the platform for translational research (Fig. 1). There is close collaboration with clinicians working in both the acute hospital and community settings. The research, encompassing both physical models and human studies, is conducted in a new purpose-designed facility at Southampton General Hospital and a recently installed environmentally-controlled room within the Wellcome Trust Clinical Research Facility in the Southampton Centre for Biomedical Research. One of our primary aims is to address the range of factors associated with seating acquired pressure ulcers (SAPUs).

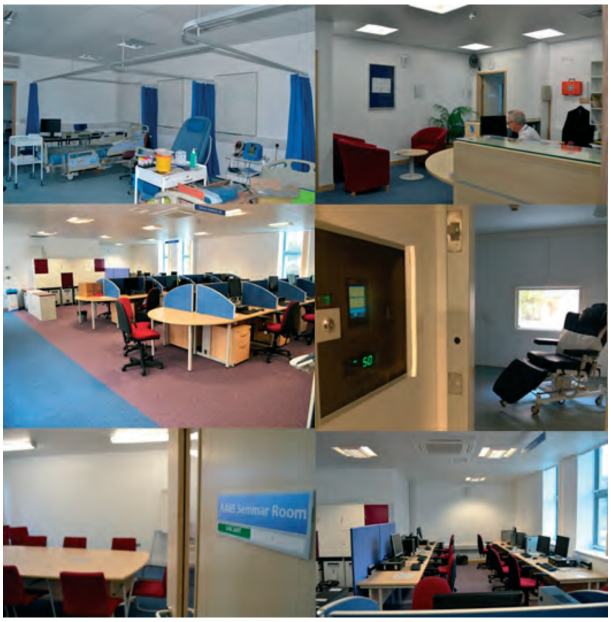

Fig. 1. The new Clinical Academic Facility in the Faculty of Health Sciences, University of Southampton

ABSTRACT

Pressure ulcers occur in a range of clinical settings and, although prevention strategies have been readily implemented, their incidence has not changed significantly. In contrast to traditional research surrounding nursing management of bed-bound patients, our research has focused on the prevention of seating-acquired pressure ulcers (SAPUs). Our multidisciplinary approach involves both laboratory testing of support surfaces as well as clinical studies supported by nurses, bioengineers and healthcare professionals. The overall aim is to translate the research findings into the prevention of SAPUs for specific patient groups, both in hospital and community settings.

WHY THE INTEREST IN SEATING ACQUIRED PRESSURE ULCERS?

Traditionally, research associated with the prevention and management of pressure ulcers has focused primarily on those relatively immobile subjects confined to bed. This has led to the development of preventative strategies in the form of low pressure and alternative pressure mattresses (McInnes et al., 2012) and evidence based guidelines on mobility whilst patients are bed-bound (National Institute for Health and Clinical Excellence, 2005). By contrast, there has been relatively little clinical emphasis on examining pressure ulcer risk and prevention whilst a person is sitting, despite the well-established associated risk (Garber and Rintala, 2003). This has resulted in clinical guidelines derived from research with a limited evidence base (Stockton et al., 2009) and, thus, it is not surprising that few UK guidelines exist to inform prevention associated with seating (National Institute for Health and Clinical Excellence, 2005). Immobility represents a key risk factor in pressure ulcers. However, a study examining pressure ulcer prevalence across university hospitals in Europe showed as much as 80% of 'at risk' patients were not frequently repositioned in a chair (Vanderwee et al., 2007). Additionally, few studies associated with SAPUs have been led by allied health professionals (AHPs). An exception was research which examined existing pressure relief strategies of patients attending a seating clinic, as prescribed by senior physiotherapists at the UK National Spinal Injuries Centre (NSIC), (Coggrave and Rose, 2003). Their assessment protocols were developed by adopting bioengineering techniques which had been proven in a research study on spinal cord injured subjects (Bogie et al., 1995).

OUR RESEARCH INITIATIVES

Our research group in Southampton is addressing the clinical problem in a series of parallel studies. These involve performing carefully controlled laboratory tests, as well as clinical studies in hospital wards and, ideally, the community setting. We have adopted a mixed method approach (qualitative and quantitative) in these studies, where we can both elicit the views of patients and carers as well as accurately measure key pressure-related parameters. The primary aim of all the research is to translate findings into clinical practice, and contribute to improving the prevention of SAPUs. Ultimately we would aim to provide evidence for national and international guidelines e.g. NICE (National Institute for Health and Clinical Excellence) and EPUAP (European Pressure Ulcer Advisory Panel).

LABORATORY TESTING: WHAT DO WE MEASURE AND WHY?

Many centres have used laboratory testing to assess the performance of support surfaces, employing a range of standardised test protocols using simulated indenters and mannequins. We, however, favour tests using healthy individuals and sub-populations of patients as a more realistic means of translating findings to the clinical setting (Fig. 2).

Fig. 2. Example of the laboratory tests which are undertaken within the facility

We are currently performing laboratory tests on cushion product designs, assessing posture and monitoring movement strategies used during prolonged sitting, with the aim of further examining the relationship between prolonged sitting and soft tissue damage. It is well known that both intrinsic (patient-centred) and extrinsic (environmental) factors can contribute to pressure ulcer formation (Bader et al., 2005). During our laboratory testing we use several different biomechanical and physiological parameters which reflect tissue viability at the loaded patient-support interface. These include:

- mapping of interface pressures (Swain and Bader, 2002)
- measures of transcutaneous blood gas tensions (Bader, 1990)
- posture positions
- biomarkers in sweat (Knight et al., 2001)
- microclimate at the loaded interface (temperature and humidity).

Assessment of interface pressure using mapping devices is becoming more common in the clinical setting (Stinson and Crawford, 2009). Traditionally, clinicians have often used parameters such as peak and mean pressures to evaluate the performance of support surfaces (Fig. 3). Other factors, such as peak pressure gradients, should also be considered (Brienza et al., 2001). However, there are several reasons why the use of interface pressure measurement alone must be viewed with caution. As an example, relatively small pressures at the skin surface may produce sufficiently large internal stresses and strains in the underlying muscles adjacent to bony prominences to cause local damage (Linder-Ganz et al., 2007). This exemplifies the importance of examining the effects of external pressures and time on the internal mechanical state of the tissue. One way to do this is to measure physiological markers such as transcutaneous blood gases, particularly oxygen and carbon dioxide, which reflect the viability of loaded soft tissues (Bader and Gant, 1988).

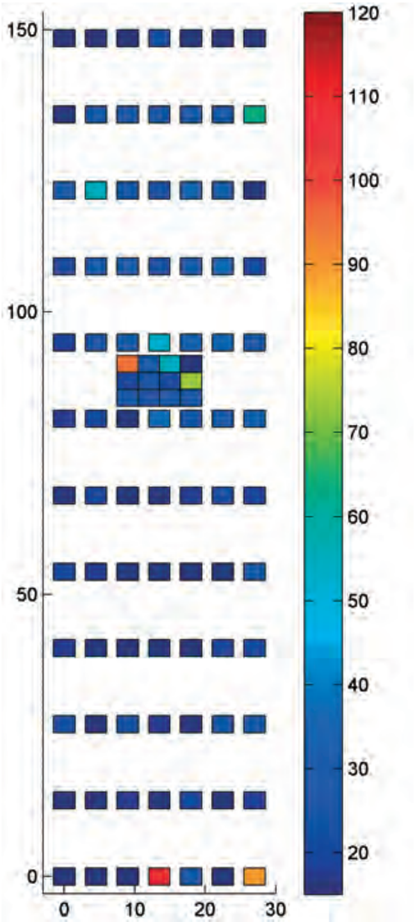

Fig. 3. Example of peak pressure measurement during a supine bed assessment

In addition to interface pressure, shear or friction are also important factors and can be greatly affected by posture in the chair. There is also the microclimate at the interface between the body and the support surface, in particular temperature, moisture, urine and faeces, each of which have been implicated in pressure ulcer development (Clark et al., 2010). The environmental chamber housed in the Wellcome Trust Facility enables us to accurately control both temperature and humidity, which is critical in evaluating the microclimate at the loaded interface. By measuring the microclimate, blood gas tensions, and sweat markers, in addition to interface pressure, we aim to provide a comprehensive assessment of how, why, and under which conditions soft tissue damage occurs.

We are also developing techniques to monitor movement in the seating position. Small sensors, effectively accelerometers, can be used to track movements of an individual for a period of up to several days. In order to verify the usefulness of tracking movements, both the validity and reliability of various devices must be established. Once this is achieved, we plan to assess the nature of movements, in terms of magnitude and frequency, of different sub-populations.

Research has shown that current recommendations for relieving pressure are not adequate for all patients to achieve complete physiological recovery of the soft tissues. This has been observed in spinal cord injury patients where the perception is that pressure relief for 30 seconds, for example lift-off from the wheelchair cushion, is enough to allow soft tissue to recover during prolonged sitting. However, results have indicated that the time needed for adequate soft tissue reperfusion (oxygen levels returning to normal basal levels in soft tissues) is closer to two minutes (Coggrave and Rose, 2003). Therefore, establishing the required protocols for adequate pressure relief is particularly important.

CLINICAL TRIALS

In terms of pressure ulcer prevention, AHPs provide an important resource related to equipment selection, positioning, mobilisation, and education of seat-bound patients (McCulloch, 1998). One of our clinical studies involves working with clinicians on hospital wards to develop a consensus regarding the appropriate composition of an effective MDT for pressure ulcer prevention, and to define how each profession can contribute to training and education. This research encompasses on-going focus groups and a Delphi survey, involving AHPs and nurses from elderly care wards of the Southampton University Hospital Trust. We will use the gathered views of clinicians (focus groups) to design an MDT approach to pressure ulcer prevention and then create a consensus document between the staff on the ward as to the role of each health care professional. Subsequently, a clinical study will be devised where we will establish the effects of the new MDT approach in terms of preventing pressure ulcers, educating patients in self-care and regular pressure relief, and increasing the knowledge of staff working on the wards.

FUTURE PLANS

Our research surrounding pressure ulcer prevention will continue to strive towards increasing the understanding of the aetiology of pressure ulcers and developing an effective MDT approach to its prevention. Currently the majority of the projects are taking place in the hospital setting, but we intend to translate our strategy into the community. Indeed, we are keen to collect views of health care workers who have a particular interest in pressure ulcer prevention/management and plan to subsequently develop collaborations which could attract research funding. Ultimately, our concern is to reduce the suffering of patients and carers afflicted with the burden of pressure ulcers.

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AN OUTCOME MEASURE TOOL FOR POSTURAL MANAGEMENT: THE SCOTI

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ABSTRACT

A simple, user-friendly posture management outcome measure tool has been developed by a team in Scotland, sponsored by the former Scottish Posture & Mobility Network (SPMN).
As well as being used to provide a degree of clinical accountability and reasoning for intervention, the tool is designed to be used with any piece of postural management equipment or intervention and across professions.
The team would greatly appreciate PMG members trialling the current version and feeding back to the team, who plan on developing it further.

In 2008 one of the SPMN's postural management (PM) subgroup teams began work on the development of an outcome measure tool. The long term objective of the project was to produce a simple, user-friendly PM outcome measure tool that could be worked into current clinical practice. The team recognised that the tool needed to be sensitive to both changes in clinical presentation and also levels of function. It was anticipated that it should also contribute to providing a degree of clinical accountability and reasoning for intervention.

Additionally, the tool would be developed to be used:
- With any piece of postural management equipment or intervention
- Across professions

The first draft of the ScoTI (Score of Therapeutic Intervention) was distributed in November 2008 with a feedback questionnaire which sought comment on layout, descriptors, and usefulness in clinical practice. Draft two was developed from the comments received and subsequently circulated locally, and amongst SPMN members for on-going comment and feedback.

In June 2012 the ScoTI was further reviewed by two of the original members of the PM subgroup team, and the current version of the tool was produced.

In its currently drafted version, the ScoTI is an outcome measurement tool which scores (on a scale of 1 – 5) the changing effect of postural management interventions on 10 identified outcomes. These outcomes include:
1. Tolerance
2. Posture (user and/or carer's perception)
3. Posture (clinician's clinical impression)
4. Access around home and community
5. Personal activities of daily living
6. Ease of use (carer and/or user)
7. Function
8. Appearance
9. Moving/transferring (carer and/or user)
10. Transportation of equipment

In order to assist the user to explain changes in posture, health status, the level of risk in the intervention, use and provision of equipment, five variances are provided (with a scale of 1 -5 levels attached to each). These include:
A. Change in posture
B. Change in health/medical condition
C. Knowledge and understanding of intervention (by carer and/or user)
D. Use of equipment (carer and/or user)
E. Equipment provision

A total score (of selected outcomes) can be gained for three periods of intervention, which are:
- Pre-intervention
- Interim-intervention
- Post-intervention

If required, percentage scores can also be worked out and the levels of intervention can be clearly compared. At this stage in its development, the team values the opportunity to disseminate the current draft of the ScoTI to PMG members via goo.gl/jT49g where it can be downloaded, along with a completed example (goo.gl/8z2aA). We urge PMG members to trial it in their clinical practice and feed back to the team on its usefulness. We expect to continue to make improvements to this outcome measure tool based upon the responses and comments provided by fellow clinicians. Please get in touch by email if you wish to discuss being involved in the trialling.

PMG RESEARCH FUND

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ABSTRACT

The PMG research fund programme has now been operating for seven years. I was lucky enough to receive a grant in 2010 to complete my Masters dissertation. This article discusses my experience of applying for a PMG grant, and will demonstrate that it is possible for a novice researcher to get assistance from PMG.

I had always been somewhat terrified of 'doing research'. Studying for my physiotherapy undergraduate degree in Australia meant that the only thing I had to do with research was a single research methods subject! And so I had managed to build up quite a research-o-phobia by the time I made it to the final year of my Masters in 2010. As you will see from my article in the next issue of the journal, I did manage to finish my research project and I actually even enjoyed it(!).

But this article is really to answer the question, why would a research-o-phobic like myself take on the added stress and work of applying for a grant to carry out such a small research project? The answer is that the grant process didn't add to my workload or stress and, I believe, actually enhanced my project. Workload-wise, I found the paperwork required to get through university insurance, NHS ethics, and research & development processes was such that I already had the answers to all the questions asked by PMG. Completing the grant application form was as simple as cutting and pasting from existing work I had done into the PMG pro-forma.

Whilst my university supervisors were incredible and knew all about research, they had no experience in wheelchair services. I anticipated that the PMG committee who scrutinised applications may well have additional insights to offer about my project and hence make it a stronger study. I found that the committee did indeed have helpful suggestions to make about my work, and these were given in an un-threatening manner. Hence going through the grant process gave me additional food for thought and strengthened my project overall.

I'm like most NHS clinicians in that I feel guilty if any time I take out of work means that my clients are made to wait longer for appointments or equipment changes. This was the main reason I applied for the money – to get myself backfilled so I could take the time I needed to do the research properly and not feel torn in all directions. I managed to find a brilliant locum to backfill me for a day a week for a couple of months, thus assuaging any guilt and allowing me to focus on the research. There was no way this would have been possible without having a grant.

Therefore, my experience of applying for a grant (in this case through PMG) is that the application process really didn't add to my workload; it strengthened my project and reduced the stress of combining research with work. I would encourage other novice researchers like myself to not be afraid of going for a grant, especially given the maximum value of a PMG grant has been raised to £7,500 from 2013.

Perhaps, given my positive research experience so far, I may even consider trying it again…

BURSAR REPORT: REVIEW OF POTENTIAL OF TELECARE SYSTEMS TO SUPPORT NEURO-REHABILITATION

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Reporting Bursar: Graham Henderson
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I work as a trainee clinical scientist at the Southeast Mobility and Rehabilitation Technology (SMART) Centre in Edinburgh, which is a rehabilitation centre that includes an electronic assistive technology service. During my training I have become interested in recent developments in mass produced consumer technology that has applications in the assistive technology field, and felt this session would be relevant to me.

The presenter began by listing clients' requirements for telecare systems; these included safety, which is the number one priority, and the ease of use of the system. Some of the limitations of current technology are poor aesthetics, and equipment that does not enable independence.

The concept of smart homes was introduced and explained by the presenter. These are homes that contain multiple pieces of programmable equipment that are all linked to each other. Examples include motion sensor activated lighting, and smoke or gas alarms that prompt the user to turn off the cooker first before sounding an alarm. To aid designers of these types of devices, a design approach for smart home technology has been developed (Orpwood et al 2005). In addition, assessing what devices an individual needs is essential to avoid the installation of costly equipment that will not be used. A matrix called the Neurological Dependability Assessment Matrix has been developed (Dewsbury and Linskell 2011) to facilitate the assessment process and to aid the smart home designer to install appropriate equipment.

In the presentation it was explained how sensors were being used to encourage and improve physical rehabilitation. It was stressed that these sensors were not designed for spying but to enable self management, with the aid of a therapist's input. Examples of sensors included tri-axial accelerometers that can measure the temporal and spatial parameters of gait. Using this type of sensor would involve a therapist setting a goal, for example the total number of steps to be taken per day. The sensor would then measure the number of steps the patient took, and provide feedback to the user and therapist to see if the set goal had been achieved.

We were told about a recent piece of video game technology being used in the rehabilitation field called the X-box Kinect, produced by Microsoft. This can monitor and record a patient's movement without the need for attaching any sensors to the patient, which is one of the key problems with current movement monitoring systems. The Kinect consists of a colour video camera, an infrared (IR) laser emitter and IR camera, from which the depth of an image can be calculated based on the pattern of projected IR light (Stone and Skubic 2011). The Kinect has

Olwen briefing Graham on his bursar duties
(photo by bursar, Paul Harrington)

great potential; however its performance needs to be tested to ensure it can be used to obtain accurate results and therefore be of benefit in assisting a patient's physical rehabilitation.

As part of my clinical scientist training I hope to undertake a design project utilising consumer technology which will aid independence for individuals with physical impairments. From this presentation I learnt key lessons about user-centred design, including how important the graphic user interface is, and how to utilise user feedback to improve the design process.

I would like to thank Nigel Harris for his engaging and very informative session. I would also like to thank PMG for giving me the opportunity to attend the NTE, which I greatly enjoyed.

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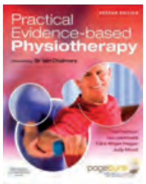
PRACTICAL EVIDENCE-BASED PHYSIOTHERAPY



Author: Rob Herbert, Gro Jamtvedt, Kåre Birger Hagen & Judy Mead
Publisher: Churchill Livingstone 2nd Edition 2011
ISBN: 978-0-7020-4270-6
Review by: Jane Pratley
Physiotherapist

This book is a systematic guide on how to incorporate a more evidence-based approach into clinical practice. The topic is introduced with clear and easy explanations into its relevance, with readers being eased into relevant terminology and engaged with the careful use of clinical examples.

BOOK REVIEW SUMMARY

This textbook offers a succinct and well organised introduction to what is evidence-based practice, how to recognise it in the research cohort, how to search for it in the many research databases available and how to use evidence to guide clinical practice. The book is specifically aimed towards physiotherapists with a bias towards musculo-skeletal practice. This should not put off others with an interest in evidenced-based practice and research as, at its core, the information can be applied across the field of all clinical practice.

The authors initially tackle how to ask relevant clinical questions and how to recognise good quality evidence, with advice given to first look for systematic reviews followed by individual research studies. They show sensitivity to the demands and challenges of the new researcher or clinician who needs to know that the evidence they are reading is of sufficient quality and what type of research study is most suitable for the clinical question they wish to answer.

A highlight of the book was the chapter on using electronic databases. Clear structured guidance is given in how to search, and how to select and combine search terms to optimize efficiency of search time. Guidance is given as to which databases are most relevant to which clinical questions. In fact they state that it should be possible, with a fast internet connection, to find the best available evidence in three minutes, so this chapter could literally save you hours of trawling!

The challenge of how to recognise good quality research from bad is approached by identifying three different questions for different types of research papers, which can help guide clinicians efficiently through the process of differentiating good quality, relatively unbiased, evidence from biased evidence produced as a result of poorly designed research.

Information is presented on how to make the step from reading a research article to figuring out what it may mean in clinical practice. A particular focus is given to interpreting statistics and identifying effect sizes to ascertain if they make the intervention or test practical and efficient in terms of both time and cost. However, these sections can make for heavy reading and could perhaps benefit from short summaries and synopses for the more casual or inexperienced reader.

Clinical guidelines are identified as a useful resource for evidence-based physiotherapy and a shorter section in the book is dedicated to how they fit into the research picture. Clinical examples and different checklist-based instruments are introduced which help to identify high quality guidelines.

The final sections of the book take a look at when new therapies could be introduced into clinical practice, how to implement change in clinical practice and how to measure changes towards evidence-based practice, which provide interesting reading.

Overall I found this book interesting and motivating to read. It is well referenced, generally succinct and written with the working clinician in mind. There is a focus on providing clinical examples to ground the book in practice and the provision of clear instruments to help the clinician identify quality research which is useful.

In presentation the book is let down by feeling slightly tired in format with the sole use of either black or blue ink and a lack of illustrations/diagrams. A small but annoying point was that the paper is quite shiny which makes it hard to read in artificial light or to annotate.

In terms of layout the book would have benefitted from clear separate summary pages, to act as quick reference guides for the clinician. Whilst there are summary boxes they get lost amongst the long sections of text and the lack of tabs on the side bars of the pages makes it difficult to flip between chapters.

This book would be great for clinicians involved in either introducing evidence-based practice into their work place, training, or carrying out research, and would perhaps be an ideal book to buy for your department with an NTE book voucher!

FASCIA – THE TENSIONAL NETWORK OF THE BODY

Authors: Ed. Robert Schleip, Thomas W Findley, Leon Chaitow & Peter A Huijing
Publisher: Churchill Livingstone Elsevier 2012
ISBN: 978-0-7020-3425-1
Review by: Linsay Stevenson BA ATP MFHP MFHA
Myofascial Release Therapist

It would be hard to overstate the importance of this book. Here we have a clearly written, scholarly, encyclopaedic account of current knowledge and understanding of the fascia by authors and contributors who are all internationally recognised in their field. Information available only widely scattered in specialist publications and scientific papers is here drawn together in an authoritative and readable format. This volume opens up an exciting new vista of our understanding of the structure and function of the human body from the standpoint of the fascia. It also examines common fascia-related disorders and provides an in-depth overview of current fascia-related therapies and their applications, ranging from manual therapies through movement, stretching and exercise (Yoga and Pilates) to diet and nutrition. The final section on research gives an insight into modern research techniques, their application, findings and pointers to their future use.

The book is well structured: section one examines the foundations of our knowledge of fascia; section two considers the clinical application of current knowledge including a useful overview of fascia related therapies; section three looks at current

BOOK REVIEW SUMMARY

This book provides a comprehensive collation of information regarding fascia by authors and contributors from diverse clinical and professional backgrounds. The text covers the structure and function of fascia, the related disorders, an in-depth overview of therapies through to their applications. The most up-to-date research techniques are discussed along with directions for future research.

research, its applications and possible future applications. All contributions have been well referenced and at the end of each chapter there is a full list of references and bibliography. Where relevant information on a topic may be found in previous or subsequent chapters, this is also clearly referenced. The book is well indexed and has a useful glossary. Additionally there are well reproduced and referenced colour plates, and excellent, well labelled black and white diagrams throughout the text which clarify the information presented.

Section one has a clear progression from the gross anatomy of the fascial system, through the relationship with the nervous system, to the detailed physiology of fascia. The growing understanding of the interrelationship of fascia with traditionally understood structure and function of muscles and the skeleton, and the role of the fascia in transmitting forces, is clearly explained. Equally, the authors are not afraid to point out areas where there is still a lack of knowledge or contradictory evidence to be clarified by future research.

The relationship between the fascia and the nervous system is explored, and interesting evidence is presented which leads towards an understanding of the ill-understood and often contentious relationship between hands on physical therapy, yoga and other bodywork and the psycho-emotional responses they often evoke.

Section two entitled ‘Clinical Application’ is useful, enlightening and thought provoking, including excellent articles on fascia-related disorders ranging widely from the common ‘frozen shoulder’ through spastic paresis to fascial involvement in the diabetic foot. There is also a most useful section on diagnostic procedures and an in-depth overview of fascia-related therapies that not only lists the “what” and the “how”, but also relates the therapy to research and clinical knowledge.

Section three looks at current research methodologies and their application. The section starts with a thought-provoking discussion of scientific research versus clinical research and makes a strong case for the two approaches to be aware of each other in order that real progress in knowledge be made and clinical practice be advanced.

The articles in this section cover the most up-to-date research techniques (MRI, ultrasound, mathematical modelling, molecular biology) and explain both the techniques and their practical application with exemplary clarity, allowing the lay reader, as well as the specialist, access to an understanding of current cutting-edge techniques and methodologies, and possible directions for future research.

In short, this is a book that will become a classic text and should find its way onto the bookshelf of anyone with a therapeutic interest in the human body.

PMG SCOTLAND PROMOTIONAL GROUP: INAUGURAL MEETING

Jenny Hooper-Roe
PMG Publications & Marketing Sub-committee

The opening meeting of the PMG Scotland Promotional Group took place on October 30th 2012 at the SMART Centre, Astley Ainslie Hospital, Edinburgh. The meeting was well attended by ex-Scottish Posture & Mobility Network (SPMN) members, members of PMG's executive committee, representatives from some PMG sub committees and not forgetting Olwen Ellis, who was described as a stalwart at PMG.

Catherine Mathieson, ex Chair of SPMN, opened the meeting by giving a short history of SPMN, and the reasons why a decision was regretfully made in April 2012 to close down the network as it was no longer viable to continue as an independent organisation. However, building on existing links with PMG, the SPMN membership and funds transferred to PMG. Catherine then explained that the PMG Scotland Promotional Group was formed to recognise the unique differences that Scotland has in relationship to the rest of the UK, and to maintain the profile of the practice and research occurring there.

Clare Wright, Chair of PMG, welcomed new members and gave a brief resumé of how PMG had become one of the leading charities in the UK over the last twenty years, with a membership of over four hundred and representation from rehabilitation engineers, occupational therapists, physiotherapists and others in the field of posture and mobility. Whilst acknowledging the sadness felt by SPMN members at its closure, Clare spoke of the excitement felt within PMG at the possibilities that this new arrangement presented.

The PMG Scotland Promotional Group will be headed by Catherine Mathieson and James Hollington. James presented the strategy of the new group which will have two main elements. Firstly the group will aim to keep existing SPMN members on board, thus promoting the good work in practice, research and development that is already taking place in Scotland. Secondly the group will concentrate on increasing the membership of PMG in Scotland and, in particular, will actively seek the involvement of wheelchair services to facilitate more integration across the UK. The main focus of the group will be to increase Scottish representation and participation in PMG.

Two projects that are underway in Scotland at the moment were highlighted. An SPMN posture management subgroup has been working on an outcome measure tool entitled Score of Therapeutic Intervention (ScoTI) in Posture Management. Details of the tool are to be found in this journal *(page 31)* and arrangements were made to set up a pilot study. The other on-going project is the Best Practice Guidelines for Supported Lying which is nearing completion.

A number of PMG members present described the activities of some of the sub-committees, providing insight into the valuable work that goes on in the background to make PMG the vibrant organisation that it is.

The meeting was notable for the air of excitement and enthusiasm amongst those present, and certainly there was a commitment expressed to ensure that Scotland will be well represented within PMG.

SCOTTISH WHEELCHAIR AND SEATING SERVICES TRAINING EVENT

James Hollington
PMG Scotland Promotional Group, SMART Centre, Edinburgh
Email: james.hollington@nhslothian.scot.nhs.uk

A two day event was held at the beginning of November 2012 for the five wheelchair and seating services in Scotland. This was a great gathering with over 80 delegates comprising of mainly engineers and therapists, but also administrators and medical consultants. The event provided a superb platform for sharing current research, knowledge and experiences. Due to Health and Social Care being devolved, it was an important opportunity for services to discuss Scotland-specific issues.

Highlights of the event included wide-ranging presentations and debates, such as The Clinical Standards for NHS Wheelchair & Seating Services in Scotland (please see goo.gl/JFumt), understanding and evaluating wheelchair cushions, the trainee clinical scientists' research presentations, and presentations sharing service delivery tools and audit information. There was also a rich selection of posters on display.

Best plenary presentation prize was awarded to Craig Kirkwood, Dundee, for a very entertaining and informative presentation on understanding foam chemistry and characteristics. Best poster presentation prize was awarded to Karl Lees & Peter Greene, Glasgow, for their excellent descriptive poster on the development of a foam carve service.

Clare Wright (PMG Chair), James Hollington (PMG Scotland Promotional Group) and Susan Hillman (PMG Research sub-committee) were kindly given a slot to promote PMG, and to launch the PMG Scotland Promotional Group, which has recently been created to increase Scottish involvement in PMG, and to encourage the sharing of knowledge with the wider membership. Arguably the most important aspect of this event for PMG was the final day's discussion on developing a clinical network in Scotland. It was agreed by all the services that they would adopt PMG as their main professional network organisation, and then set up smaller networks between Scottish professional groups for local information sharing.

This was a great event for linking services in Scotland.

SCOTTISH WHEELCHAIR AND SEATING SERVICES

The Mobility and Rehabilitation Service (MARS), Aberdeen
Tayside Orthopaedic and Rehabilitation Technology (TORT) Centre, Dundee
Southeast Mobility and Rehabilitation Technology (SMART) Centre, Edinburgh
West of Scotland Mobility and Rehabilitation Centre (WestMARC), Glasgow
Highland Wheelchair and Seating Service (HWSS), Inverness

IMPROVING WHEELCHAIR SERVICES MEETING THE NHS INSTITUTE, WARWICK UNIVERSITY

Alexander Kamadu, Henry Lumley and Linda Marks
PMG Strategy & Policy Sub-committee

The Department of Health (DH) held a meeting (hosted by the NHS National Innovation Centre (NIC)) on 26th October 2012 with those PCTs who had signalled their intention to prioritise wheelchair services for early extension of patient choice of provider (AQP) in 2012/13. At the end of July, the DH signalled that it was removing the national deadline of December 2012 for the implementation of extending patient choice of provider in wheelchair services. Nationally 47 PCTs had initially selected wheelchair services as a priority for service improvement, but they have now had time to reflect on whether AQP is the right approach. The DH explains that the reason for lifting the national deadline is to ensure the wider NHS has more time to work locally with providers and other commissioners.

Looking ahead, it seems that commissioners have greater local discretion on whether and when to use AQP. Personal health budgets have also been suggested as a way of providing better choice. NHS Continuing Care funded clients (both adults and children) will be offered a personal health budget by 2014, and similar commitments have been given for children who are formally assessed as having Special Educational Needs. Personal budgets are a way of giving people more choice and control over how their needs are met. Personal budgets for adults receiving social care are well established, but are new in healthcare and for children's services – both of which are currently being tested.

In adults, personal health budgets have been piloted in England since 2009, and the final evaluation report is due in November (goo.gl/1e8qP). Subject to the evaluation, there is a clear government commitment to roll them out across England.

The Department for Education and the DH are jointly testing a single assessment and plan for children with special educational needs and disability (SEND) (goo.gl/fuq29). Subject to evaluation, these assessments and plans will cover education, health, and social care and include the option of a personal budget. The pathfinders have recently been extended, and will run until September 2014. Equipment, wheelchairs, and mobility aids will come within the scope of the single assessment, plan, and personal budget.

It does seem that the DH and some commissioners have taken on board feedback from PMG and the NWMF representatives. At the workshop, there was better acknowledgement of the logical split in service between the situation in which an assessor prescribes a standard non-modular wheelchair and when the assessor prescribes a wheelchair/seating that needs modification to meet the individual needs of the client. The former group may well end up being commissioned through an AQP/extended choice model, possibly building on the existing voucher approach to allow patients to access a wider range of wheelchair providers. There is also recognition that the latter group need to be supported by a more integrated model, and that AQP may not be the best approach to commissioning complex care.

PMG has a significant opportunity to influence what the model might look like for both client groups.

THERE WERE 2 WORKSHOPS ON THE DAY:

A. WORKSHOP WITH COMMISSIONERS

1. A national strategic procurement review is to be undertaken by John Warrington, Deputy Director, Policy & Research in the DH Procurement, Investment & Commercial Division. He will extend an invitation to a range of stakeholders to be involved in a task and finish group, and is expected to deliver a paper by late February 2013. The scope for this was likened to the work put in to the digital hearing

aids service in the 1990's, when consolidated procurement enabled an 80% cost saving on the new technology.

2. The NHS Supply Chain is to include a wider range of wheelchairs, seating, and also repair service providers in the existing catalogue. It is not mandated for providers to use NHS Supply Chain, and providers can continue to negotiate prices locally with suppliers if they have the expertise and resources to do so.

3. NHS commissioners agreed that a different commercial approach may be needed for the specialised and complex spectrum of services. For example, the hub and spoke model was thought to be a good model to operate for meeting the requirements of clients with more complex needs, as the focus was on long-term care management and outcomes. Commissioners identified the need for critical mass in maintaining specialist clinical and technical skills. This approach may facilitate collaborative joint commissioning and funding (with potential cost savings between education, social services/local authority, and health).

On the other hand, it was thought an alternative procurement model for people with less complex needs where there is patient choice from multiple providers may be appropriate. A prescription approach would be consistent with patient choice, possibly building on the existing voucher model. Existing local providers would need to be 'accredited' to undertake the assessment, and help users identify a provider for their mobility solution. Commissioners were keen to ensure that local community teams have the skills to undertake routine assessments, and that these skills are embedded in existing care pathways and not seen as an extra to avoid the risk of double payment. **PMG and NWMF may be well placed to develop a competence framework for clinical assessors, accreditation, and standardised assessment templates, based on examples of best practice.**

4. Some commissioners were frustrated that local providers were not supplying them with information related to the breakdown of activity based on case complexities. Commissioners need this information to better understand the different segments of the wheelchair services. Other commissioners were concerned that changes to provision could end up costing significantly more in the absence of collaborative commissioning. **It is vital that providers start collating and understanding the information based on complexity of needs, and sharing this with their commissioners to help support commissioning decisions.**

5. There was a general sense that commissioners had well established relationships with providers across the country. There is significant benefit from early dialogue with providers. Commissioners should be encouraged to maintain good engagement with their current local providers, many of whom may welcome the opportunity for a discussion on how to improve service responsiveness.

Some commissioners were concerned about the cost implication of moving to a tariff system. Commissioners were conscious that current providers manage spend and utilise robust eligibility criteria to meet demand and desired outcomes. The historic eligibility criteria can be a barrier to joint commissioning with local authorities, and are not well aligned with a focus on outcomes for individuals. Other commissioners are working to revise restrictive eligibility criteria so that there is a greater focus on meeting holistic outcomes for the individual.

It was acknowledged that collaborative commissioning would be a suitable option. There was, however, a sense that this has been talked about in detail before but not successfully established across the country. There are pockets where this currently works well.

6. **'Child in a chair in a day'** – The title of this website cannot be changed (goo.gl/8uGHM), although it has been widely acknowledged that this has been a significant issue for a wide range of stakeholders. A new strap line has been created: *right assessment, right equipment, right first time* which is more reflective of best practice. There was a strong message that there was a need for service improvement for both adults' and children's services. 80% of wheelchair users are adults, and older people in particular have been overlooked.

This is a virtual space for commissioners, service users, suppliers, and providers to share information and facilitate access to wheelchair services in general. **More case studies on best practice are required and contact details are available on the website if any wheelchair service wants to publish examples of best practice. It is imperative that wheelchair services start to utilise social media platforms like this to tell their story.**

7. Generally there was a message that the high profile of driving improvements to wheelchair services remains, but that this was now more focussed on delivering lasting and measurable service improvement and "getting it right" than solely on implementing AQP. The DH appears to now recognise the complexity in aspects of these services.

The definition of the highly complex aspects of service remains to be clarified in light of the recent recommendations of the Clinical Reference Group on specialised services *(see Margaret Hannan's article on page 42).*

8. The government commitment to giving patients greater choice and control will be set out in the NHS mandate given to the NHS Commissioning Board (CB). Looking ahead, both the NHS CB, as the commissioner of specialised services, and local Clinical Commissioning Groups, will have a duty to promote and enable patient choice. This will include patient choice of provider (AQP) but also the extension of personalised health budgets.

9. A further stream of work, prioritised by the DH, is to develop a national tariff structure for wheelchair services. This work is being overseen by Craig Holmes at the DH but may be contracted to an outside agency. The scope of the work does not currently include specialised services.

B. CHAIR4LIFE WORKSHOP

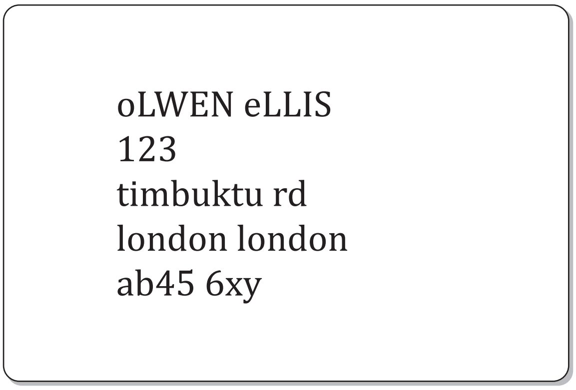
NIC recently launched a competition to facilitate the next stage of research and development of a modular paediatric wheelchair incorporating a child growth system (Chair4Life concept). The objective is to design and develop an innovative wheelchair prototype by building on past research, and by engaging with a range of stakeholders.

1. A relatively small group attended the workshop on 'Chair4Life'. Philip Charlton-Smith gave a brief presentation on the organisation of wheelchair services in the UK, and the essential differences between England (where service is either NHS therapy assessed and then supply is outsourced or all in-house) compared to Scotland and Wales which both have variations of in-house provision.

2. Rob Chesters from the NHS Innovation Centre gave a very short presentation of the work they did developing a powered paediatric chair for the most complex 20% of clients. He reported that the current project was to develop a powered chair, not exclusively paediatric, suitable/adaptable for 80% of clients. Little information was supplied on how this request developed/where it originated from. Renfrew (who were awarded the contract) have till the end of January 2013 to come up with a specification.

3. A working group of three or four tables went through a checklist of criteria for the 'said' chair – this has now expanded into a list of 108 criteria to be scored by the following Monday. The deadline for responses was extended to 9th November as some participants wanted to get consumer feedback on the criteria. It is unclear how this group will proceed.

DID YOUR ADDRESS LABEL LOOK A BIT LIKE THIS?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If you notice that the information we have for you is wrong, or just not formatted correctly, the reason is that we simply download your contact details exactly as you keyed them into the PMG membership website when you originally signed up.

Why not take the opportunity to tidy up your membership account details (if they need it) when you come to renewing your PMG membership in January 2013?

NATIONAL COMMISSIONING IN ENGLAND APRIL 2013: IT'S HAPPENING!

Margaret Hannan
PMG Representative on the Clinical Reference Group (CRG) for Complex Disability Equipment
Email: m.hannan@nhs.net

From April 2013 the National Health Service Commissioning Board (NHSCB) will be responsible for commissioning Primary Care Services in England, while Clinical Commissioning Groups (CCGs) will have responsibility for commissioning the majority of the remaining NHS services for their local populations. However, certain specialised services will be a core responsibility of the NHSCB rather than being 'devolved' to CCGs. The rationale behind this arrangement is to protect services that are provided to small numbers of patients, possibly at a relatively high cost (and therefore a financial risk to CCGs) and where there are comparatively few providers.

BACKGROUND

A Clinical Advisory Group (CAG) was set up to establish which services should be considered 'specialised'. The existing 'highly specialised services' commissioned by the National Specialised Commissioning team were automatically included, and the CAG then used the Specialised Services National Definitions Set (SSNDS) as the basis for further work. To support them in this work, about 60 Clinical Reference Groups (CRGs), each representing a different specialised service area, were created.

Each group consists of at least 13 members: One public health lead, one commissioner lead, 8-12 clinicians from the relevant service areas, two patient and public engagement representatives, up to four representatives of national organisations related to the specialty, and a chairperson providing clinical leadership.

The Complex Disability Equipment Clinical Reference Group was asked to make submissions to the CAG for the following specialist areas:

- Specialist Wheelchairs/Seating
- Environmental Controls
- AAC/Communication Aids
- Prosthetics
- Orthotics
- Artificial Eye Service

Recognising the role of the Posture & Mobility Group, the Complex Disability Equipment CRG invited representation from the organisation, and I drew the short straw! I'm a clinical scientist working in rehabilitation engineering, and started my career with Tayside Rehabilitation and Engineering Services in 1986, when equipment was positively medieval. Much has changed, thankfully. Over the years I've worked in a number of wheelchair and seating services, and it has been really interesting to see how different organisations rise to the challenge of providing an invaluable service that is badly underfunded. Other members of PMG are also on the group, but were invited primarily because of their clinical or managerial roles in the relevant service areas.

The members of the Complex Disability Equipment CRG were very grateful for the enormous amount of work done by Linda Marks and Krys Jarvis to support the Specialist Wheelchairs/Seating submission prior to the CRG being established formally. Building on their work, we developed a specification that was submitted to the CAG for consideration. The CAG subsequently recommended that a service for users of Specialist Wheelchairs/Seating should be commissioned nationally. Of the remaining specialist areas covered by the Complex Disability Equipment CRG, all except orthotics were recommended for national commissioning.

Information about the CAG recommendations can be found on the Department of Health's website (goo.gl/LzZMM). We've been advised that the service specifications should be in the public domain by mid-December 2012, so do check the DH website for updates.

WHAT NEXT?

Of course what we're all passionate about is improving the outcomes and experience for service users. National commissioning should ensure that consistent standards are met across the country as all specialised service providers will be working to the same contract. The first challenge, as with all change, will be implementing the new arrangements without destabilising services that are currently in place, and ensuring a seamless service for users.

As we move forward, there is more work to be done by CRGs. The existing Complex Disability Equipment CRG will continue to support commissioning of Specialist Wheelchairs/Complex Seating in the short term by:

- Engaging with existing service providers and users to tackle issues that might arise in the short and medium term
- Refining/clarifying the definitions and standards within the specification
- Developing quality measures

However, there will be some re-configuring of the CRGs and their functions. A consultation about this is open as I write (14th November 2012). So, as usual, things may change again before we've even got our heads round the last set of proposed changes. All we can do is take every opportunity to try to shape whatever future lies ahead. If you wish to get in touch about any aspect of the CRG's work, please feel free to contact me.

ADDITIONAL READING

1. On 19th October, Margaret attended a meeting hosted by London South Bank University, sharing the platform with Krys Jarvis of the National Wheelchair Managers Forum. The theme was "to help advantage and enable the skills of AHPs through National Commissioning". Download the report at: goo.gl/ets8A
2. For information about *National Commissioning of Specialised Services* access goo.gl/bDBk7

Read about the *Specialised Services Commissioning Innovation Fund* in Section 89 of *Commissioning Intentions*: goo.gl/dkOGL

AUTUMN MEETINGS IN SCOTLAND

First of all, very many thanks to the PMG members in Scotland who welcomed the committee members and staff so warmly, and supported us throughout our three day visit.

The sun shone brightly as the contingent travelled north from Edinburgh to Perth on the third day, and the autumn colours of Perthshire were spectacular to behold. Although this lovely photograph was taken further north again, it gives a hint of the beauty that surrounded us on the journey. A big thank you to Geoff Bardsley of the TORT Centre, Dundee, for the photography.

(SEE PAGES 37 AND 38)

South Side of Loch Tummel, by Pitlochry

Goodbye to a special year
London 2012