Contents

1. PROGRAMME

The conference programme is subject to change at the discretion of PMG

Registration Desk and Exhibition Open Times

	Mon 15 July	Tues 16 July	Wed 17 July
Registration Desk Hall 3 Foyer	15:00 – 19:00	08:00 – 19:00	08:00 – 15:00
Exhibition – Hall 3	Exhibitors set up only	08:00 – 17:00	08:00 – 15:00
Conference Proceedings		09:00 – 17:00	09:00 – 15:30

Exhibition Hall 3

Organisations that are exhibiting at **PMG2024** are listed in the separate Exhibition Catalogue. In addition, don't miss the wheelchair rugby demo area and wheelchair skills and testing area at the back of Hall 3:

GB Wheelchair Rugby
Representatives from GB Wheelchair Rugby are on hand to demonstrate and let you have a go at Wheelchair Rugby.

Go Kids Go Zone
Go Kids Go have been providing training to training for young wheelchair users and healthcare professionals across the UK and Ireland since 1990. The sessions at PMG will give the practitioner a chance to experience some of the challenges faced by wheelchair-using clients and to practise wheelchair skills techniques for overcoming these challenges. There will be a strong focus on how to teach these techniques to younger clients. The sessions will include learning key skills such as back wheel balancing and an introduction to wheelchair sports and dance.

Learning Outcomes:

- Recognising the key differences of various types of wheelchairs (for example; rigid frame vs folding frame)
- Recognising how the setup of a wheelchair impacts on the user's experience
- Understanding back-wheel balancing techniques
- Be able to demonstrate techniques for ascending and descending Kerbs in a wheelchair
- Recognising how wheelchair games, sports and dance can help to encourage independent mobility in both manual and powered wheelchairs.
- Be able to differentiate activities to suit the needs of the client group.

Monday 15 July		
WHEN	**WHAT**	**WHERE**
15:30 – 17:00	**SPEED NETWORKING** ***Bariatrics: how big a problem is it?*** ***Bring any questions*** ***Navigating NHS management systems*** ***Technical innovation, including AI and robotics***	**Hall 3 Foyer**
19:00 – 22:00	**Welcome Evening**	**The Gallery**

Tuesday 16 July		
WHEN	**WHAT**	**WHERE**
08:00 – 08:45	**BREAKFAST and Exhibition**	**Hall 3**
09:00 – 09:20	***Opening Address:*** **Nathan Robson** **PITCH YOUR POSTER! Directed by Mark Bowtell**	**Ironbridge 1**
09:20 – 10:20 **PL1.A** **PL1.B**	**PL1: OPENING PLENARY SESSION** Chaired by Bex Oakes ***Functional Neurological Disorder (FND)*** Dr Elizabeth Mallam, Consultant Neurologist, North Bristol NHS Trust ***FND is a feminist issue*** Dr Caoimhe McLoughlin, Centre for Clinical Brain Sciences, University of Edinburgh	**Ironbridge 1**
10:05 – 10:20	**Refreshments for exhibitors**	**Hall 3**
10:20 – 11:20	**MORNING BREAK and REFRESHMENTS** **Exhibition - poster viewing - wheelchair rugby - wheelchair skills**	**Hall 3**
11:20 – 11:55	**PL2: PITCH YOUR PRODUCT!** Chaired by Helen Nelson	**Ironbridge 1**
12:00 – 13:00	**BREAKOUT SESSIONS: Morning**	**First Floor**
B1	***Innovation processes to meet the needs of people with disabilities*** **-** Laura Brown, West Midlands Rehabilitation Centre & Abigail Needham, Devices for Dignity AND ***Igniting the Conversation Regarding Indoor Walking as a Determining Factor in Eligibility Criteria for NHS Wheelchair Provision*** - Michaela White, AJM Healthcare	**Ironbridge 1**
B2	***Developing Best Practice Guidelines for the Stability Evaluation of People Seated in Wheelchairs and Special Needs Buggies*** Jennifer Brady, Nicola Holbrook, Dave Long	**Wenlock 1&2**
B3	***Quality in Design Development at WestMARC*** - Sara White, WestMarc AND ***Bridging the Gap: From Standards to Reality in Headrest-Backrest Design*** - William Dauncey, PDR Design, Cardiff Met and Ben Aveyard, Swansea Bay UHB	**Wenlock 3&4**
B4	***Exhibition viewing***	**Hall 3**
B5	***Are We Satisfied With Current Seating Technology Outcomes Or Should We Strive To Achieve More****? - Bart Van Der Heyden & Filipe Correia, BES Healthcare*	**Ironbridge 3**
B6	***The Ethics of Getting Out of Bed*** - Jennifer Stanek, AJM Healthcare AND ***The importance of giving it a go*** - Sabrina Robinson and Bicky Ho, Oxford University Hospitals	**Coalport**
12:30 – 13:00	**Lunch for exhibitors**	**Hall 3**
13:00 – 14:00	**LUNCH** **Exhibition - poster viewing - wheelchair rugby - wheelchair skills**	**Hall 3**
14:00 – 15:00	**BREAKOUT SESSIONS: Afternoon** (as morning sessions above)	**First Floor**
14:45 – 15:00	**Refreshments for exhibitors**	**Hall 3**
15:00 – 16:00	**AFTERNOON BREAK and REFRESHMENTS** **Exhibition - POSTER PRESENTATIONS Q&A - wheelchair rugby - wheelchair skills**	**Hall 3**
16:00 – 17:00 **PL3.A** **PL3.B**	**PL3: PLENARY 3** Chaired by Tim Adlam Feedback session from networking – Table facilitators ***Artificial intelligence (AI) and Assistive Robotics*** Praminda Caleb-Solly, Professor of Embodied Intelligence, University of Nottingham **End of day's proceedings**	**Ironbridge 1**

Gala Dinner **19:00 – 01:00**	**19:00 Pay bar open** **19:45 Gala dinner** For ticket holders only. Smart casual dress code (no jeans or trainers please).	**Ludlow Suite**

Wednesday 17 July		
WHEN	**WHAT**	**WHERE**
08:00 – 08:45	**BREAKFAST and Exhibition**	**Hall 3**
09:00 – 09:10	***Welcome to Wednesday / housekeeping*: Nathan Robson**	**Ironbridge 1**
09:10 – 10:20	**PL4: Plenary 4** Chaired by Dave Long	**Ironbridge 1**
PL4.A	***Assessment and management of childhood dystonias*** Dr Jean-Pierre Lin, Consultant Paediatric Neurologist, Evelina London Children's Hospital	
PL4.B	***Assistive technologies including splinting for the management of contractures in Stroke patients - results of a systematic review*** Rasheed Meeran, Director and Consultant Physiotherapist, Hope Rehab Ltd and Venu Durairaj, Director, Beacon Neuro Physio	
10:05 – 10:20	**Refreshments for exhibitors**	**Hall 3**
10:20 – 11:20	**MORNING BREAK and REFRESHMENTS** **Exhibition - poster viewing - wheelchair rugby - wheelchair skills**	**Hall 3**
11:20 – 13:00	**FREE PAPERS** Chaired by Lorna Tasker	**Ironbridge 1**
FP1	***Improving Spinal Cord Injury Wheelchair Provision: a collaborative pilot project between AJM Healthcare and two Spinal Cord Injury Centres*** Emma Linley, Royal National Orthopaedic Hospital and Sarah Dowie, Imperial Healthcare NHS Trust	
FP2	***Combining artificial intelligence and a dynamic sitting system to promote good posture and pressure relief*** Dr Silvia Caggiari, University of Southampton	
FP3	***Development of a robust postural care process of assessment, analysis and implementation to enhance professional practice and student outcomes for students with complex physical disability*** Corinne Phillimore and Anesu Madondo, National Star College	
FP4	***Is my in-situ sling dangerous whilst travelling in a vehicle?*** Nicola Holbrook, West Midlands Rehab Centre, Birmingham	
12:30 – 13:00	**Lunch for exhibitors**	**Hall 3**
13:00 – 14:00	**LUNCH** **Exhibition - poster viewing - wheelchair rugby - wheelchair skills**	**Hall 3**
14:00 – 14:15	**Exhibition continues after lunch**	**Hall 3**
14:15 – 15:15	**PL5: PLENARY 5** Chaired by Mohamed Mirghany	**Ironbridge 1**
PL5.A	***Steering-by-Leaning in manual wheelchairs*** Reto Togni, ETH Zürich	
PL5.B	***Alternative Power Chair controls: a Framework for maintaining independence*** Jacob Eltherington, Specialist Rehabilitation Engineer, KCLH, Bowley Close Rehabilitation Centre, London Suzannah Shari, Specialist Wheelchair Therapist, GSTT, Bowley Close Rehabilitation Centre, London	
15:15 – 15:30	**PRIZE GIVING** Chaired by Bicky Ho Best Free Paper & Best Poster at conference **Close of proceedings**	**Ironbridge 1**

2. WELCOME FROM CHAIR OF CONFERENCE

I am delighted to welcome you to the 30th PMG conference. First and foremost, I want to extend a special thank you to Helen Critten-Rourke, our immediate past CEC Chair. Helen's dedication and hard work have laid a remarkable foundation for this conference. Her vision and leadership have been instrumental in shaping the success of our events. Helen, we are grateful for everything you have done.

We also bid farewell and express our sincere thanks to Olwen Ellis for her contributions to PMG. Olwen's commitment and efforts have been pivotal to our success, and her presence at the conference will be sorely missed. Olwen, thank you for your dedication and for being a familiar and friendly face at our conferences over the years.

As we say goodbye to people, we are also excited to welcome new ones to the PMG family. Having attended the conference multiple times in the past and always found it rewarding, I have been given the opportunity to continue Helen's hard work as Chair of the CEC. This role has given me new insight and appreciation for the hard work that goes on behind the scenes.

I am thrilled to welcome Lisa Thompson to our management team. Lisa has truly hit the ground running, and her exceptional organisational skills have been vital in keeping us on track. Her enthusiasm and hard work have been invaluable in organising this conference, and we are fortunate to have her on board. Lisa, your energy and dedication are greatly appreciated, and we look forward to your continued contributions.

A sincere thank you also goes out to the members of the Conference, Education, and Communications (CEC) committee and the executive committee, who are all volunteers. Our team assesses submissions, including bursary applications and free paper abstracts. Your input, ideas, and hard work have been instrumental in shaping this year's conference. The collaboration and commitment you bring to the table ensure we continue to deliver high-quality and impactful events. Thank you for your dedication and for making this conference possible.

As with any event the size of the PMG conference, despite all the planning, there may be things you find not to your liking, or you may have done differently. We welcome your comments both at the conference, where we can put things right, or in your feedback afterward.

Once again, welcome to this year's conference. We hope you find it inspiring, informative, and enjoyable. Thank you for being here and for your continued support of PMG.

Warm regards,
Bicky Ho
Conference, Education and Communications (CEC) Committee Chair
July 2024

3. IMPORTANT INFORMATION (A-Z)

ALCOHOL: Only the venue is licenced to provide alcohol at this event. If any attendee is found consuming alcohol not provided by the venue, or providing alcoholic drinks for others at the event, they will be asked to leave.

ATTENDANCE BADGE: You must wear your attendance badge throughout the event – without it you will be refused entry to the exhibition and conference proceedings.
Please note: you will also not be admitted to the Gala Dinner without your badge.

ATTENDANCE CERTIFICATES: these will be provided after the event, only for those attending conference proceedings.

BREAKFAST: Breakfast on Tuesday and Wednesday mornings will be available for all attendees from **08.00 to 08.45** within the exhibition in Hall 3.

BUSINESS FACILITIES: The following services are available from the TIC Reception office (charges apply): internet and e-mail access; printing and copying; laminating; secretarial work.

CONFERENCE PROCEEDINGS: All conference proceedings take place on the first floor. The plenary sessions and free paper presentations are in Ironbridge 1. Room allocations for breakout sessions are shown on the conference programme. The abstracts of proceedings are published in this book, see Contents page 3.

CONTACT NUMBERS:
PMG Conference Team: + 44 (0)7471 459820
TIC reception: + 44 (0)1952 281500

EVACUATION PROCEDURES: In the event of an emergency evacuation, please follow instructions from TIC staff. They will direct you to the assembly point and assist anyone with accessibility requirements who may need extra support.

EXHIBITION: The PMG2024 exhibition in Hall 3 is open **08:00 – 17:00 Tuesday 16 July** and **08:00 – 15:00 Wednesday 17 July.**

FIRST AID: First aid assistance is available onsite. Should first aid be required, a TIC team member will attend immediately and, if not first aid trained, will radio for the duty manager.

GALA DINNER: The Gala Dinner will be in Ludlow Suite on the Ground Floor on the evening of **Tuesday 16 July** from **19:45**, followed by an after-party and disco. There is a pay bar which will be open from 19.00.
The Gala Dinner is for ticket holders only. You MUST bring your badge with you for scanning at the entrance. The dress code is smart casual, and the Conference Committee kindly request that no jeans or trainers are worn.

LOST PROPERTY: Lost property should be handed into the TIC Reception office.

LUNCH & REFRESHMENTS: Lunch and refreshments will be **served in the exhibition during break times** on Tuesday 16 July and Wednesday 17 July. Catering points are clearly marked on the Exhibition Floor Plan (see Exhibition Catalogue).

PARKING: The venue has an onsite car park, with over 1,500 spaces, including disabled bays close to the entrances to the venue. If you require accessible parking, you are advised to use Gate B, car park CP4 and entrance E4. Parking is free of charge for PMG2024 attendees, and there is no height restriction. There is also some parking available at the onsite hotels.

POSTER PRESENTATIONS: The posters are located within the exhibition. Poster presenters will be available for Q&A next to their posters during the afternoon break at **15:00 – 16:00 on Tuesday 16 July.**

PRAYER ROOM and QUIET ROOM: A Prayer Room and a Quiet Room are located in the Pattingham Suite on the Ground Floor, just before Hall 3.

SMOKING: TIC is a *No Smoking* venue, and this includes the use of e-cigarettes. There is a designated area for smokers outside the main entrances E2 and E3.

TAXIS: TIC reception staff are happy to book taxis for you. Pick-up is from outside the main entrance E1 or E2.

WELCOME NIGHT: A free Welcome Evening is taking place on **Monday 15 July from 19.00 until 22.00** in the first-floor Gallery at The International Centre. A free meal will be provided, along with one free drink. Please pick-up your voucher at registration.

WI-FI: Free Wi-Fi is available during the event. Access details are **Username:** TICUK
No password is required

4. PLENARY 1 — Tuesday 16 July 2024

Location: Ironbridge 1 — Chair of the session: Bex Oakes

4.1 PL1.A

Functional Neurological Disorder (FND)

Dr Elizabeth Mallam, Consultant Neurologist, North Bristol NHS Trust

Functional neurological disorder (FND) is experienced by around 1 in 6 people who attend the general neurology clinic. Historically it is was frequently misunderstood by neurologists and other doctors, and so people with FND often experienced a difficult time getting a diagnosis and being referred for treatment. Advances over the past 20 years have significantly improved our understanding of FND, and how to treat it. I will review these advances and how we can feel more positive about what we can do for people with FND.

4.2 PL1.B

FND is a feminist issue

Dr Caoimhe McLoughlin, Centre for Clinical Brain Sciences, University of Edinburgh

This session examines some aspects of Functional Neurological Disorder (FND) through a feminist lens. Issues such as status, equity and power imbalance may affect why FND is diagnosed more in women, and such issues also influence their healthcare trajectory. Potential ways to address these issues will also be discussed.

5. PLENARY 2: Pitch Your Product Tuesday 16 July 2024

Location: Ironbridge 1 Chair of the session: Helen Nelson

A: Spex Ltd - Constructa Cushion

The Constructa system is a range of modular cushions which can adapt to accommodate complex postural needs for all users. Research shows that asymmetric limited hip flexion is closely linked to the development of other conditions, including pelvic obliquity, trunk asymmetry, scoliosis and windswept hip distortion (Ágústsson, A. et al, 2017).

Through the unique puzzle joints, this cushion can accommodate for limited hip flexion (both symmetric and asymmetric) as well as leg length discrepancies and other complex presentations often associated with custom seating.

The adaptable three-part cover system and pressure integrated positioning blocks; complex users can be seated and supported within one session (even as part of the MAT assessment process) rather than the traditional timelines associated with custom products. On top of this, the product allows for further refinements and adjustments to either improve the outcomes or to adapt with the user and their requirements.

B: Loopwheels (Jelly Products) - Loopwheels Urban

Loopwheels Urban are wheelchair wheels with integral suspension for active wheelchairs. An independent study conducted by the University of Pittsburgh and published in 2024 has found a significant reduction in whole body vibration and shock, compared with spoked wheels and Spinergy CLX, for wheelchair users with Spinal Cord Injury manually propelling over different surfaces. This presentation will summarise the findings and why this is important for people who use a wheelchair every day.

C: CoMoveIT - CoMoveIT Smart

CoMoveIT Smart is a unique wheelchair steering utilizing Artificial Intelligence to empower individuals with complex movement disorders through independent mobility. Originating from collaborative research at Belgian's University KU Leuven, CoMoveIT addresses the significant challenge faced by many people diagnosed with cerebral palsy, who struggle with conventional methods of wheelchair control. CoMoveIT Smart is a head only or head-foot steering that was developed by integrating scientific insights and evidence in close collaboration with the users. It's receiving high praise from therapists and users for its usability and functional impact. With its adaptive algorithm and personalized configurations, it offers a therapeutic driving experience with seating symmetry, facilitating independence and societal participation.

Through real-life videos of user cases, we'll showcase the tangible benefits of CoMoveIT Smart in enhancing the quality of life for individuals with complex movement disorders.

D: Sunrise Medical - RIDE Designs Custom Seating

Established in the United States for over 25 years, the RIDE Designs custom moulded seating range is coming to the United Kingdom and Ireland. Through advanced scanning and 3-D printing technology, it has the thinnest profile of any custom moulded back worldwide. Mounting is via a unique hardware system that allows height, lateral, angle and rotation adjustment without any custom framing. This allows active self-propellers to have custom moulded support and enables compatibility with more compact wheelchair bases, for access and proportionality with small or young clients. It also simplifies spare parts for busy wheelchair services and reduces time to provision.

The RIDE Custom 2 seat uses patented shaping technology underpinned by principles of orthotic seating to load safe areas and offload high risk areas, showing excellent results in clinical studies at Georgia Tech university. An airflow option to help manage microclimate or a more immersive foam option are available.

E: Etac - Star Sentinel, Powered by Kalogon

Star Sentinel, powered by Kalogon, was launched in 2024 to bring the benefits of advanced air management to users of vertical air cell cushions. This innovative device simplifies Star cushion setup, maintains optimal air levels automatically, alerts users to problems, and eliminates the need for regular manual air level checks. Sentinel is similar in weight to a mobile phone and fits neatly into the front pocket of the Star cushion for convenience.

Our short 'Pitch Your Product' presentation will showcase the Star Sentinel and highlight its integration with the optional mobile app. We will also discuss the device's potential use by both active users, who like to take control of maintaining their own support surface, and more complex users, who may otherwise struggle to maintain their air cushion.

Gezond & Zeker and RegioPlus in the Netherlands have shortlisted Star Sentinel, powered by Kalogon for their Health & Safe Innovation Award.

F: GB Wheelchair Rugby

Wheelchair Rugby is a team sport for athletes of any gender with a physical impairment. The object of the game is simply to carry the ball across the opposing team’s try line. It involves full contact between the chairs. Of course, it’s not quite as simple as that! Come and give it a try if you are brave enough.

6. BREAKOUT SESSIONS Tuesday 16 July 2024

6.1 B1

B1.A: Innovation processes to meet the needs of people with disabilities

Laura Brown, Birmingham Community Hospitals NHS Foundation Trust and
Abigail Needham, Devices for Dignity NIHR, HealthTech Research Centre in Long term conditions

Calling all innovators, innovation sceptics, and purse-string holders - come and chat with us this PMG about how we can improve our services to better meet our users' needs!

Why do we need innovation?

In a context of ever-tightening budgets, ever-increasing demand for services and complexity of clinical need, making time for high-quality innovation can be a big ask, even when many of us agree that going on as we have done is no longer realistic.

Approach to innovation

Part presentation, part workshop, this session will define innovation and the approach to healthcare innovation developed by Devices for Dignity NIHR HealthTech Research Centre in Long term conditions, focusing on co-creation of solutions through patient and public involvement and engagement (PPIE). Laura will share her recent experience of the Healthcare Science Innovation Fellowship and her innovation project, 'Exploring power assistance for self-propelled wheelchair users during rehabilitation'. The project focused on the adoption and spread stage of the innovation process, which historically is poorly resourced in the NHS (Collins 2018).

The workshop will ask attendees about their own interest in and experience of innovation for patient benefit and will be very interactive! Innovation is challenging in the best of circumstances. The authors feel there are issues specific to the field of assistive technology and rehabilitation, which we would like to explore with you and consider different routes and resources for obtaining support.

If you have an interest in healthcare innovation, we would love you to attend!

Background

The Healthcare Science Innovation Fellowships Programme is an opportunity for qualified Healthcare Scientists and aims to equip Fellows with the knowledge, skills and confidence for the development, evaluation and implementation of new technologies, and the ability to initiate and lead their own technology innovation projects in the future. Fellows have access to blended project–based and online learning and training resources and mentoring to undertake a technology innovation project.

The programme is a collaboration between the Office of the Chief Scientific Officer for NHS England, and the National School of Healthcare Science (NSHCS) and is delivered by Devices for Dignity NIHR HealthTech Research Centre in Long term conditions (D4D). D4D work with people living with long-term conditions (across the life course from very young children to older adults) and bring together teams to catalyse technology development in response to unmet needs, which, if addressed, will deliver the most impact for patients, carers and health and social care.

Devices for Dignity works across four clinical themes:

- Long-term neurological conditions (LTNC)

- Diabetes
- Kidney care
- Women's Health

which are supported by four cross-cutting themes:

- Rehabilitation, Assistive and Restorative Technologies (RART)
- Mental Health and Wellbeing
- Methodological Innovation (MI)
- Pathways to Implementation and Impact (PII)

Reference

Ben Collins 'Adoption and spread of innovation in the NHS', 2018, The King's Fund

B1.B: Igniting the Conversation Regarding Indoor Walking as a Determining Factor in Eligibility Criteria for NHS Wheelchair Provision

Michaela White, AJM Healthcare

Summary
A need has been identified to engage in conversations regarding indoor walking ability assessments as this is often a determining factor for provision of NHS wheelchair services. This paper explores experiences, guidelines, and research in the hopes of making recommendations to wheelchair services for improved and consistent assessment method and decisions in this area of provision.

Aims and Objectives
The aim of this paper is purely to ignite the conversation regarding assessing mobility indoors linked to wheelchair provision. It is to highlight the lack of clear and consistent guidelines available currently to wheelchair clinicians for determining when a person can safely and functionally mobilise indoors despite this often being a determining factor of eligibility for provision through wheelchair services. From these conversations, objectives will be set to create clearer guidelines and tools on how to approach wheelchair provision when being required to implement eligibility criteria which outline indoor mobility as a defining determinant of provision through wheelchair services.

Background
Wheelchair services' clinicians are required to draw on many skills to assess and prescribe appropriate mobility and postural systems to best enable function and mobility. Each service is provided with eligibility criteria which serve as a guidance on what the service can provide to facilitate mobility and postural support within the greater conceptualisation of an individual within the International Classification of Function (ICF) model.

One aspect of these assessments includes assessing an individual's ability to mobilise safely and functionally in an indoor setting. This is often a determining factor in eligibility for provision, however there is no apparent guidance on how to assess this consistently and for the variety of people seen across the lifespan in the wheelchair services.

There seems to be inconsistency in these decisions, likely influenced by various factors, e.g. subjectivity of assessors, varying levels of experience, conceptualisation of an individual, ambiguity and interpretations of eligibility criteria, variety in or lack of formal clinical qualifications of wheelchair service clinicians. Clinical qualifications in wheelchair services generally include physiotherapy, occupational therapy, clinical science, and rehabilitation engineering, often supported by unqualified staff e.g. assistants and technicians. These varied training backgrounds could lead to varied outcome of how an individual is assessed for indoor mobility needs, and therefore eligibility to provision through the relevant wheelchair service.
Consulting with various health care professionals that advocate for the provision of wheelchairs for individuals provided valuable input what they consider to be important when assessing walking ability to determine wheelchair provision. One identified that it is "hard to assess if only mobility is considered as a service user might be able to get themselves from point A to B indoors, but hardly tells anything about their function, quality of movement, or effort involved" (Pardiwala, 2024). Another healthcare professional emphasized that function may not be limited to indoors as individuals have various environments in which they engage with (Taylor, 2024). It was also identified that physiological cost index is not commonly looked at when assessing mobility but highlighted as something that should be considered (Taylor, 2024). Physiological cost index includes how difficult, or energy consuming walking is. Another suggested that effort of walking, distance of walking, repeatability and replication, and safety should be considered when assessing functional mobility when determining wheelchair provision (Smith, 2024). From these discussions,

it was clear that there was no clear outcome to determine what is safe and functional mobility, but only components to consider when assessing it.
Research and existing guidelines for best practice shows to have non-specific and unclear guidance in making clinical assessments to determine what is safe, functional indoor walking when determining eligibility to wheelchair provision. These include many assessment tools such as the 6-minute walking test, berg balance scale, gait analysis, functional motor scale, and Gillette Functional Assessment Questionnaire. However, no outcome or suggestions on how to intervene with the results from these are available and are left open ended. This may be due to these being used in a variety of settings, but there is a clear need for a wheelchair provision assessment tool to determine consistently when wheelchair provision is required.
The evaluation of the safety of walking is multidimensional (Kaegi et al., 2008), however, "no standardized clinical assessment of gait safety has been identified" (Kaegi et al., 2008). Quinn et al. (2011) identify that many outcome measures have gross motor sections but there is limited that concentrate specifically on the assessment of functional walking.
The research has also shown to be specific to groups of people, such as children with cerebral palsy, older adults, or specific diagnoses and provides no clear definition of what safe, functional mobility is with measurable outcomes to be able to determine this. These assessment tools also do not take into consideration whether a person's condition is stable, deteriorating, or rapidly deteriorating.
Walking ability is a complex element of individuals to assess as it is multidimensional and has no clear definition. However, there is a need for clearer guidelines to allow for consistent indoor walking ability assessment for improved clinical reasoning for fair provision of wheelchairs through wheelchair services.

Discussion

Experience working as a wheelchair clinician has revealed that there are many factors and perspectives that can influence assessment outcomes of determining walking ability, but limited guidance in having a framework or set of guidelines to assist in making consistent decisions regarding provision of wheelchairs for mobility needs when indoor walking is often the determining factor.
This has highlighted that there is a need for service development to assist in providing consistent and fair provision of wheelchairs to people. Quinn et al. (2011) reiterates that there is a need for a simple tool to measure functional mobility consistently and precisely. More so, to provide guidance on when provision of wheelchairs is needed from the outcome of this assessment tool.
It is recommended that this paper instigates the discussion and identification of the lack of consistent guidance around functional mobility related to wheelchair provision. It is hoped that this prompts further discussions to delve deeper into this topic and results in a future set of guidance to for wheelchair services. How that might look is unknown currently, but one idea is an easy-to-use assessment tool to guide the clinical reasoning and assessment process to allow for consistent and objective outcomes of the assessment of walking ability related to wheelchair provision. This might evolve, but the aim to keep it a simple tool/guideline that can be used at ground level by all clinicians.

References

Kaegi, C. et al. (2008) 'Development of a walking safety scale for older adults, part I: Content validity of the gem scale', Physiotherapy Canada, 60(3), pp. 264–273. doi:10.3138/physio.60.3.264.
Pardiwala, P. (2024) RE: Indoor Walking Research. Personal Email communication 02.01.2024
Quinn, A., O'regan, M. and Horgan, F. (2011) 'Psychometric evaluation of the functional walking test for children with cerebral palsy', Disability and Rehabilitation, 33(25–26), pp. 2397–2403. doi:10.3109/09638288.2011.573057.
Smith, R. (2024) RE: Indoor Walking Research. Personal Email communication 05.01.2024
Taylor, J. (2024) RE: Indoor Walking Research. Personal Email communication 04.01.2024

6.2 B2

Have your say - Developing Best Practice Guidelines for the Stability Evaluation of People Seated in Wheelchairs and Special Needs Buggies

Jennifer Brady, Nicola Holbrook, Dave Long

Summary

A workshop to share the current development of best practice guidelines, and to engage people in the issue of wheelchair stability, sharing clinical experiences and highlighting the importance of finding optimal stability. This session aims to develop the best practice guidelines, drawing on the expertise of those who attend.

Aims and objectives

The working group would like to raise the profile of this important area of work and would value the input of the broader PMG membership into the development of these guidelines. The workshop will be a presentation of work to date, encouraging an open discussion on current methods for stability testing, clinician experiences, examples of good practice, challenges around wheelchair stability, and priorities for the guidelines. This guideline aims to compare methods currently used, to provide guidance on when and how testing should be implemented, managing risks using patient goals, and optimising functionality for the wheelchair user and their family/carers.

Background

Following a free paper presentation on the subject at the PMG conference in 2023 a group of experienced clinicians has assembled to develop best practice guidelines on this subject to aid healthcare professionals who prescribe wheelchairs, special needs buggies, seating systems, and Electronic Assistive Technology (EAT).

Technique

The framework was developed through review of evidence in literature, existing processes and documentation, and historic practices. Alongside the experience of contributing authors, the varying methods for evaluation currently in use have been considered, largely based on the resources available to conduct such tests. The group would like to canvas the opinion of professionals in the field on current practice, challenges and priorities for the guidelines.

Standards/guidelines

Current standards relating to stability testing have been considered, including BS EN 12183:2022, BS EN 12184:2022 and ISO 7176. Further documentation available includes the BHTA Guidelines on Stability for Wheelchair Users, MATdoc Best Practice and Usage, and MHRA Guidance on Stability DB2004. This documentation provides information on test methods and factory standards but lacks instruction on the evaluation of the result in relation to the person using the equipment, and also lacks individualised ‘real world’ applications, usage and environmental considerations.

Clinical detail

The guidelines aim to provide an overview of current practice, methods available for stability testing, and practical recommendations for best practice that can be implemented into clinical services. This will help professionals to evaluate the outcome in line with the risks/benefits and patients' goals to ensure they get the best from their equipment.

Results and testing

The guidelines currently include recommendations for accurate reporting of tipping angles and conditions, with further interpretation and recommendations to accompany the test results. Future scope of the document to include the views of professionals in the field on defining failures, what to do in the case of failure, managing risks/benefits, risk management case studies, and clinical use of these scenarios.

Discussion

We aim to provide practical means for services to evaluate stability, and to determine when it is or isn't required. This will aid understanding of the varied access to equipment used for stability evaluation, suggest different evaluation methods, and help understand the scenarios when stability evaluation could be appropriate with only minimal equipment (including EAT/wheelchairs/special needs buggies/modifications of equipment beyond manufacturers use).

By publishing this information, hopefully the attitude toward stability can come closer to reaching a consensus – minimising the difference in approach based on the location of wheelchair provision.

Group members:
Nicola Holbrook - Birmingham Community Healthcare NHS Foundation trust
Nathan Robson – AJM Healthcare
Dave Long – AJM Healthcare
Jennifer Brady - Swansea Bay University Health Board
Stephanie Wentworth – Cardiff and Vale University Health Board
Mark Bowtell – Swansea Bay University Health Board
Beth Gill – Betsi Cadwaladr University Health Board
Louise Whitehead – Birmingham Community Healthcare NHS Foundation trust
Lorna Tasker - Swansea Bay University Health Board
Mike Ryan - Birmingham Community Healthcare NHS Foundation trust
Neil Gregory - Birmingham Community Healthcare NHS Foundation trust
Paul Dryer – Kings College Hospital NHS Foundation Trust

B3.A Quality in Design Development at WestMARC

Sara White, WestMARC, QEUH, Glasgow

Summary

The West of Scotland Mobility and Rehabilitation Centre (WestMARC) has been ISO-13485 (Medical Device Quality Management System) registered since 2012. WestMARC manufactures medical devices to fit wheelchair bases, these are a mix of standard designs and/or bespoke designs.

Plan to discuss WestMARC's approach to maintaining ISO-13485 standards with reference to design and development.

Aims and objectives

Plan to outline WestMARC's approach to the design and development requirements for maintaining ISO-13485. WestMARC manufactures medical devices to fit to wheelchair bases; these are a mix of standard WestMARC designs and/or bespoke customised designs.

The quality requirements will be outlined for design planning, inputs, outputs, verification, validation, transfer, and review. This will also include detailing design risk assessments and user information.

WestMARC has now had many internal audits and external audits by BSI. Many lessons were learnt for implementing a new design development process as a result of the audit process.

Background, Technique, Standards, Clinical Detail, Results and Testing

In 2019, Medical Device Directive (MDD) was planned to be changed to Medical Device Regulation (MDR); WestMARC implemented many steps to ensure compliance (even though laterally this was not required in UK due to Brexit).

Now medical device designs are regulated under UK MDR 2002. WestMARC designs are normally classified as a Class I Medical Device as per Classification Rules for non-invasive devices. Devices are not placed on the market, so CE marking is not required.

Design work is only undertaken by HCPC registered Clinical Scientists. Initially staff should attempt to fulfil prescriptions using commercially procured devices, where not suitable, a Standard WestMARC designed component is sought.

Designs may include

(1) In-house manufacture - where a device is designed and manufactured in-house.

(2) Modification - where a commercially procured device is modified in some way to alter its function.

(3) Off-label use - where a commercially procured device is used in a manner outside that intended by the manufacturer.

All designs require a unique design file, as required by ISO-13485. The extent of the design file should reflect the complexity and risk associated with the device. WestMARC uses Q-pulse Quality management software to control documentation, this includes design files, technical files, procedures, prescription forms, drawings, risk assessments, assembly instructions, material data sheets, calculation and tests.

Standard WestMARC Designs are those suited for use across a wide patient cohort, which allows manufacture and stocking of a design, available to all prescribing staff (for example modular seating or arm pads). Other

WestMARC designs are one-off bespoke items, designed specifically for an individual patient (Custom Build Design).

Auditing is a requirement of ISO-13485. WestMARC has now had many internal and BSI external audits for design and development. Most audits identify areas for improvement resulting in additional workload. It is important that WestMARC management continue to allocate adequate resources to allow for these improvements to benefit to patient care.

Significant effort has been put into ensuring appropriate user information is supplied for WestMARC standard designs. Work has also been put into creating design files in addition to technical files to show how a standard design adapts for improvements or coping with unforeseen changes. The importance of staff training on prescription completion and manufacturing instructions have also been identified. Since the MDD changes WestMARC has tried to improve design verification with more testing (for example seating crash tests and material flammability testing).

For WestMARC bespoke designs, the main change was to introduce more formalised risk assessments at point of recording a design, not only at delivery. Reviews highlighted gaps in paperwork and a design checklist was introduced. Small group meetings were introduced to share/ review each other's designs; this helped staff to appreciate the required detail. It was beneficial to highlight alternative risk factors.

Monthly design reviews have continued at team meetings. Sharing design findings helps staff to be aware of other ongoing designs and may help to improve other patient's equipment provision.

Discussion

Novel designs offer significant benefits to patients, as off-the-shelf components often cannot be adequately configured to suit. It is important that new designs continue to be used without introducing undue risk to patients.

It is challenging to introduce additional design tasks for clinicians already under a significant workload. Design reviews offer important learning and reflection within the team. Independently reviews help to highlight alternatives and or improvements available, and or potential safety concerns.

Quality lead designs allow for continual improvements to benefit patients.

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BS EN ISO 13485: 2016 Medical Devices - Quality Management Systems - Requirements for Regulatory Purposes

B3.B Bridging the Gap: From Standards to Reality in Headrest-Backrest Design

William Dauncey, PDR Design, Cardiff Met and **Ben Aveyard**, Swansea Bay UHB

Summary

This research investigates real-world wheelchair use scenarios and compares them to testing standards, highlighting design improvement opportunities for headrests and seating. We used a custom developed mechanical test rig to replicate forces defined in ISO standards and as measured from a user case study in controlled conditions.

Aims and Objectives

- Analyse a case study of a custom wheelchair backrest failure and the potential cause.
- Quantify forces generated by a wheelchair user who previously experienced backrest failure in real-world scenarios.
- Compare real-world user force data with the ISO 16840-3 standard for postural support devices.
- Develop a custom test rig to replicate real-world and standard testing conditions.
- Test custom wheelchair seating under controlled parameters for failure point identification.
- Share insights on using ISO 16840-3 and real-world data to inform safer and more user-friendly wheelchair design.

Background

Wheelchair headrests and seating exhibit significant variation in design and configuration. Current understanding of their performance under standard mechanical testing (e.g., ISO 16840-3) and real-world use is limited. Existing data also lacks analysis of how established testing standards address actual wheelchair user experiences and component failure. This gap suggests potential for design improvements to enhance user safety and experience.

Methods

1. Case Study Analysis: We analysed a case where a custom fabricated wheelchair backrest failed, investigating the likely scenario that led to the failure.

2. Real-World User Data: We measured the forces generated by an adult wheelchair user with a neurological condition. This data captured the nature and location of force application in real-world settings.

3. Standard Comparison: We compared the real-world user data with the ISO 16840-3 standard, which focuses on static, impact, and repetitive load strengths for postural support devices.

4. Custom Test Rig Design and Fabrication: We constructed a mechanical test rig specifically tailored to replicate both real-world and standard testing conditions.

5. Custom Seating Testing: Custom wheelchair seating was subjected to controlled testing on the developed rig. Parameters included force levels, speed, duration, number of cycles, and failure point identification.

Results

- The case study analysis revealed potential design weaknesses in the custom backrest that could have contributed to the failure.

- Real-world user data showed significantly different and more dynamic force application compared to the static and repetitive loads outlined in the ISO 16840-3 standard.

- Testing on the custom rig demonstrated potential weaknesses in the current custom wheelchair seating designs where failures could occur during extreme cases where users excerpt forces beyond the norms defined in the ISO standard. This suggests that the standard may not sufficiently capture the demands of actual wheelchair use.

Discussion

The research highlights a disconnect between the demands of real-world wheelchair use and current testing standards like ISO 16840-3. By combining case study analysis, real-world user data, and custom testing, we gain valuable insights into design vulnerabilities and identify opportunities for improvement. The development of a custom mechanical test rig allowed for targeted evaluation of wheelchair components under conditions more representative of actual use.

Implications for Wheelchair and Seating Manufacturers

- Incorporating real-world user data and dynamic testing protocols into the design process can lead to more robust and durable wheelchairs that better withstand actual use conditions.

- Manufacturers can utilise the insights gained from this research to optimise headrest and seating designs for improved safety and user experience. There is an opportunity to optimise designs based on user weight and the forces they are likely to apply.

- Collaboration between wheelchair users, researchers, and manufacturers is crucial for developing effective testing standards and implementing evidence-based design improvements.

By bridging the gap between standard testing and real-world use, this research contributes to the development of safer and more user-friendly wheelchairs, ultimately improving the quality of life for wheelchair users.

6.4 B4

Exhibition viewing

6.5 B5

Are We Satisfied with Current Seating Technology Outcomes Or Should We Strive to Achieve More?

Bart Van Der Heyden and **Filipe Correia,** BES Healthcare

Summary

This session will review the history and development of back support interventions for wheelchair users and explore their current limitations. Examining biomechanical and postural outcomes of various interventions, and illustrating the practical implications for wheelchair users. This session will review an alternative seating approach and identify associated measurable outcomes.

Aims and objectives

To provide a review of the development and current methods of providing back support to wheelchair users, to ensure the audience fully understand the biomechanical outcomes of different types of intervention and the subsequent postural results, along with their limitations. Having gained a good understanding of the background, then exploring the option of providing "segmented variable postural support" and reviewing the measurable outcome and benefits of this alternative approach. This session combines theoretical learning through a series of explanatory graphics along with interactive practical demonstration.

Background

PSIS, lumbar support and back support recline systems can provide many benefits to wheelchair users, but there are several limitations to consider. Examination of each intervention and consequence enables a better level of understanding of the limitations and offers an opportunity to explore a new approach.

Technique

An in-depth biomechanical analysis of the outcomes of PSIS, lumbar support and back support recline interventions showing the theoretical, and actual, effects on posture. Using this analysis to understand the limitations of such interventions and further exemplifying these limitations using case studies.

Clinical detail

The following biomechanical and postural effects commonly seen in practice following back support intervention will be discussed and illustrated:

- With severe passive seating the centre of mass moves forwards and the lumbar / PSIS support does not prevent sliding.
- If the shape of the PSIS and lumbar support is not ideal the support might not be effective and can result into sliding.
- Passive seating is linked to fatigue of the postural muscles and changes are likely to occur overtime during the day.
- Most back supports are two-dimensional and too high.
- Customisation of back supports can be difficult to execute.
- Reclining of the back support will change the position of the secondary positioning systems such as head supports, and lateral trunk supports.

These clinical situations will be presented and discussed in detail through case studies and biomechanical demonstrations.

Results and Testing - illustrating the results of biomechanical interventions in theoretical and case study form.

Discussion

Following a review of the current back support interventions and their limitations, it is clear that these interventions can have many negative effects on the end user and their carers. The evaluation of a new postural management system shows functional benefits for clients when making both dependent and independent postural changes for function and for clients with postural fatigue and passive seating tendencies as well as the ability to absorb voluntary and involuntary movements for clients with tone changes. On this basis it would seem prudent to review the approach to the provision of back supports.

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B6.A: The Ethics of Getting Out of Bed - a look at ethical and practical problems when dealing with very medically risky service users

Jennifer Stanek, AJM Healthcare

Summary

Clinical practice/case study. This presentation would be an examination of ethical and practical considerations around practice when a service user with mental capacity wishes us to undertake an intervention that could endanger him.

Aims and objectives

To allow clinicians to begin to consider the moral, ethical and practical questions around risky interventions, specifically looking at weighing up our duty of care to protect service users from harm against their right to make what we would consider an unwise decision.

Background

A service user in our catchment requires custom moulded seating following a period of prolonged bed rest. He has full mental capacity. He has a spinal cord injury and autonomic dysreflexia - known triggers include bladder and bowel issues, including catheter dislodgement and hoisting. He has a DNR in place, as well as an advanced decision to decline any medication for autonomic dysreflexia. He wishes the process for custom moulded seating to be followed as per usual and is fully aware of the risks.

This has raised several fairly unique ethical and practical considerations which are worth exploring in a wider forum to raise awareness of the issues more widely. The COT Professional standards for occupational therapy practice, conduct and ethics (2021) states "Your duty of care is your responsibility to act in a way that ensures that injury, loss or damage will not be carelessly or intentionally inflicted on the individual or group to whom/which the duty is owed as a result of your actions." but also "You uphold the right of individuals and groups to make choices over the plans that they wish to make and the intervention that you provide". How do we reconcile this in relation to this situation? This presentation does not aim to provide solutions or answers beyond the very specific ones to this case, but instead aims to get delegates thinking about the issues raised and how they might apply to their own practice.

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B6.B: The importance of giving it a go

Sabrina Robinson and **Bicky Ho**, Oxford University Hospitals

Summary

To present the importance of recognising the principles of posture management (focussing on the value of not causing damage to the body) and the importance of giving it a go with respect to complex interventions. Sheila (63, advanced PD) presented with significant lower limb spastic motor changes and contractures. Sheila had received most care in bed for 2 years; she had been told she was unseatable. It was identified that the support surface (bed) was contributing to several secondary complications and therefore causing harm, if not addressed, this harm would likely result in tissue damage, further limitations to function, and pain. Trialling for seating was considered essential, as was addressing other aspects of 24-hour posture management.

Aims and objectives

- Recap of the 3 Elements of good posture
- Assessment of needs
- Intervention vs non-intervention – Risks and benefits
- Benefit of 24-hour posture management
- Outcomes

Clinical Detail

A thorough assessment, focussing on body shape and biomechanical considerations, led us to clinically reason that the significance of lower limb asymmetries was compounding overall postural presentation; risk factors associated with non-intervention were subsequently increased. In our clinical judgment, we considered timely intervention to be essential to preserve the already limited joint ranges which were being negatively impacted by the bed. It was also recognised that Sheila was at a very high risk of developing pressure ulcers, and that if this occurred, there would be no alternative positions for off-loading. By weighing-up the risks of non-provision and benefits associated with potential intervention, seating (wheelchair and shower) and lying support options were explored despite a successful outcome being considered unlikely. Thankfully this was not the case – not only was Sheila's risk of secondary complications related to her posture better managed, but she was able to access her local community and visit local family at home. Transport options were explored, and this is still ongoing.

Discussion

Our service has seen a trend in the increase of complex patients being managed in the community; this is the likely result of many challenges faced by the NHS and social care as well as the aftermath of COVID.
We would like to encourage other professionals to recognise the importance of 24-hour posture management and the impact it has on the person holistically; receiving care in bed is not necessarily the least damaging option. We would recommend tackling complex body asymmetries with all available resources before making absolute recommendations. It is recognised that significant time and resources are needed to fully explore such complex cases, this may include seeking second opinions, giving it a go, and cross-agency working.

Reference

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7. PLENARY 3 — Tuesday 16 July 2024

Location: Ironbridge 1 — Chair of the session: Tim Adlam

7.1 PL3.A

Feedback from Speed Networking

The table facilitators will summarise the discussions, and feedback from Monday afternoon's Speed Networking.

7.2 PL3.B

Artificial intelligence (AI) and Assistive Robotics

Praminda Caleb-Solly, Professor of Embodied Intelligence, University of Nottingham

Assistive and rehabilitation robots offer the possibility of providing more frequent and flexible support to help people self-manage their activities of daily living and rehabilitation more independently. However, given that people's sensory and physical conditions are likely to change over time, it is important to measure and track any changes that will contribute to intelligent adaptation of the level and type of functional support and therapy that an assistive robot can provide. In this talk, Prof Caleb-Solly will cover research on intelligent sensing, embodied AI for assistive and rehabilitation robotics, and how digital twins are being considered in this context to create, learn and maintain a multi-dimensional, personalised health profile, that can evolve with a person, as well as be able to predict and simulate adaptations for short- and long-term changes in conditions.

8. PLENARY 4 Wednesday 17 July 2024

Location: Ironbridge 1 Chair of the session: Dave Long

8.1 PL4.A

Assessment and management of childhood dystonias

Dr Jean-Pierre Lin, Consultant Paediatric Neurologist, Complex Motor Disorders Service, Evelina London Children's Hospital

Childhood dystonia and associated movement disorders may occur at any time in the maturing childhood nervous system posing challenges to the development of growth, posture, movement and function attainment. Causes vary from static structural brain injuries, collectively known as the ***cerebral palsies*** and other later acquired brain injuries in 2/3 of cases, and genetic movement disorders in the remainder 1/3 of cases. ***Dystonia*** may occur alone but is often mixed with ***chorea***, ***athetosis*** and ***myoclonus*** which are also universal motor patterns observed in healthy new-borns and young infants.

Estimated cases of Dystonic Cerebral Palsy (DCP): If the annual UK birth rate is 700,000, the incidence of CP is 2-3/1000 live births and 80% of these have signs of dystonia, there are 1,120-1, 680 with dystonic CP (DCP) born each year or upwards of 17,920-26,880 cases of dystonic CP age 2-18 years, not including genetic and idiopathic dystonias. If perfect health prevailed, there would be 87,360-131,040 cases of DCP age 2-80 years which represents a significant morbidity and clinical need. This talk will briefly review the pathophysiology of dystonia, a simple dystonia severity grading system: Dystonia Severity Action Plan: DSAP; and practical management and advanced therapeutic strategies.

Selected references:

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10. DE Lumsden, M Kaminska, H Gimeno, K Tustin, L Baker, S Perides, Keyoumars Ashkan, Richard Selway, Jean-Pierre Lin
Proportion of life lived with dystonia inversely correlates with response to pallidal deep brain stimulation in both primary and secondary childhood dystonia
Developmental Medicine & Child Neurology 55 (6), 567-574

8.2 PL4.B

Assistive technologies including splinting for the management of contractures in Stroke patients - results of a systematic review

Rasheed Meeran, Director and Consultant Physiotherapist, Hope Rehab Ltd and
Venu Durairaj, Director, Beacon Neuro Physio

Background

After stroke, it is frequent to develop alterations in soft tissues, contractures are common in patients with varying degrees of severity and those who do not recover useful function. Contractures can interfere with function and cause cosmetic and hygiene problems. Preventing and managing contractures might support rehabilitation and recovery after stroke. The purpose of this systematic review and the subsequent meta-analysis is to bridge the gap in literature by analyzing evidence for the effectiveness of assistive technologies for management of contractures in adults with stroke.

What are assistive technologies?

AT are devices that use electrical currents or mechanical means (e.g., splinting) to provide a stretch to muscles and soft tissues. We wanted to know whether AT interventions are effective for the treatment and prevention of contractures (limb deformities) in adults with stroke.

What are contractures?

After a stroke many people develop limb deformities which are caused by muscles and tendons getting shorter and stiffer and the main cause for contractures are immobilisation of the limb in a shortened position. Contractures are exacerbated when spasticity (i.e., abnormal muscle activity) is present.

Objective

To assess the effects of assistive technologies for the management of contractures in adults with stroke.

Selection criteria

Randomized controlled studies (RCT) that used electrical, mechanical or electromechanical devices to manage contractures in adult stroke patients were included in the review. We planned to include studies in which assistive technologies (AT) were compared against routine therapy, or against another assistive technology to maintain or improve passive range of motion or to maintain or reduce stiffness.

What did we find?

We found seven small studies which contributed to this review. Appropriate patients were included in the studies and the methods used, whilst having a high risk of bias, were also appropriate. Studies compared AT against routine therapy. Electrical stimulation (ES), splinting, positioning wrists using hinged board and a non-robotic device with electrical stimulation were the AT used in these studies. The outcome measures of interest were passive joint range of movement (PROM), stiffness, function and pain. The treatment duration offered to participants in the studies was variable between four and 12 weeks.

Key message

Due to the small number of poor-quality studies, we are unable to conclude with certainty whether treatment with AT was superior to conventional treatment. A positive relationship between AT and pain could not be established with limited number of studies, in the upper limb. Further research is needed to ascertain the effectiveness of AT and adverse effects of AT for the management of contractures.

9.1 FP1

Improving Spinal Cord Injury Wheelchair Provision: a collaborative pilot project between AJM Healthcare and two Spinal Cord Injury Centres

Emma Linley, Royal National Orthopaedic Hospital and
Sarah Dowie, Imperial College Healthcare NHS Trust

Service Development pilot project

Typically, Wheelchair Services provide an interim wheelchair to support discharge from spinal cord injury rehabilitation and then follow the user up once they are home. This practice has led to a deterioration in the provision of equipment that often does not allow ease of mobility, supported posture or maintained skin integrity with a subsequent loss of skills, injury and inability to access the community. More recently some Wheelchair Services have not been able to provide any wheelchair for discharge.

Discussion between the London Spinal Cord Injury Centre, the National Spinal Injuries Centre and AJM Healthcare allowed the recognition of the need for improved timeliness and quality of provision for people being discharged from their first episode of rehabilitation following a spinal cord injury and that changes in current practice were required.

The aim of the pilot project was to provide a mid-term manual wheelchair or powered wheelchair (dependent on user need) with posture and seating requirements in time for discharge from the user's first episode of spinal cord injury rehabilitation. In order to achieve this a number of processes needed to be removed from the pathway to be able to streamline the timing of prescription identification, support direct ordering and provide delivery to the SCICs for set up before the person's discharge.

A new pathway was devised whereby the users SCI therapist and a senior seating SCI therapist completed a wheelchair and seating prescription in a joint assessment with the individual and a representative from the Wheelchair Services preferred equipment provider. The prescription was drawn up from a pre-determined list of preferred equipment used by each Wheelchair Service to ensure maintenance could be carried within the Wheelchair Services Approved Repairers contract. A formalised prescription was sent to the SCI on the day of the assessment for review by the senior seating therapist which was then sent to the Wheelchair Service for direct ordering with delivery to the SCI for set up.

At the time of submitting this abstract the pilot had only just started but by conference in July we will be able to share six months of data and outcomes, what has gone well and not so well and any required changes to the pathway.

It is hoped that this project has the potential to demonstrate the ability to improve service provision so that the SCI user receives the right wheelchair at the right time at no additional cost to the NHS across both organisations and with saved time for Wheelchair Services. If successful such a system could be adopted nationally across all Wheelchair Services.

References:

2006 Out and about; Wheelchairs as part of a whole-systems approach to independence (wheelchairmanagers.org.uk)

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2005 Standards for NHS-Commissioned Wheelchair Services (wheelchairmanagers.org.uk)

2015 Formation of the Wheelchair Alliance with the Wheelchair Charter

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2017 Model Service Specification for Wheelchair and Posture Services, NHS England

2019 SCI rehabilitation: a wasted resource without appropriate mobility, posture, skin integrity and life role enhancing provision, Spinal Cord Injury Therapy Leads (SCITL) for UK and Eire

2022 An Economic Assessment of Wheelchair Provision in England, A report prepared by Frontier Economics and commissioned by Motability and The Wheelchair Alliance

9.2 FP2

Combining artificial intelligence and a dynamic sitting system to promote good posture and pressure relief

Dr Silvia Caggiari, University of Southampton

Summary

Our work describes a technical challenge of integration of Artificial intelligence with a dynamic sitting system which automatically reacts to shifts in position, ensuring optimal posture through a closed loop of pressure sensitive air cells. This represents a solution to facilitate active movements, providing postural correction, relief pressure points, and ultimately pressure ulcer prevention.

Aims and objectives

Our work aimed to integrate artificial intelligence (AI) technology with a dynamic seating system, to automatically detect postural changes whilst sitting, promote postural support while maintaining skin health. Aergo Health technology is a novel dynamic chair which incorporates a closed loop of six pressure sensitive air cells for postural correction and pressure relief whilst sitting. Objectives were to:

- Investigate biomechanical response, involving interface pressure at the skin-seat interface, actimetry data and cycling inflation/deflation of the air cells, during a range of different postures.
- Develop a data set of postural patterns and internal air cell pressure outcomes, implementing an AI algorithm for air cell adjustments associated to pressure relief and postural correction.

Background, Technique, Standards, Clinical Detail, Results and Testing

Amongst the seating systems available, the majority offers static support, with generic cushions unable to adapt user position and allow movements, limiting the possibility to actively self-manage posture (Strobl, 2015). Their static nature can contribute to an increased time spent in the same posture which represents a risk factor for the development of skin and soft tissue damage in the form of pressure ulcer (PU) (EPUAP,2019). Over the last decade, interface pressure measurements have been employed in a variety of settings e.g., clinical, automotive, to assess the seat interface conditions and promote optimal postures. It has been recently demonstrated that interface pressure can act as surrogate for movement (Caggiari, 2019), with Artificial Intelligence (AI) algorithms able to automatically detect posture and mobility events (Caggiari, 2020). However, technical challenges are represented by the integration of AI with these devices to automatically provide postural correction, pressure relief, and corresponding PU prevention.

We designed an experimental study recruiting twelve participants under institutional ethics (ERGO 26379). Participants were asked to sit on the Aergo chair while adopting five different static postures, each of them held for 10 minutes and allocated in a random order according to a standardised protocol (Worsley, 2016). The chair was set up in a responsive mode which involved automatic adjustments in the internal air cell pressure following postural changes. Continuous measurements included interface pressure (SumitomoRiko, Japan) at the seat support, actimetry data at trunk and pelvis (Shimmer, Ireland), and internal pressure of the air cells.

Area under the Receiver Operating Characteristic (AUC) curve was used to evaluate sensitivity and specificity of all parameters in detecting postural change events, examining the 1st spatial derivative (Caggiari, 2020). Principal Component Analysis (PCA) was applied to a data set representing the most accurate parameters to identify clusters indicative of static postures following root mean square error normalisation. Their prediction

was assessed with Convolutional Neural Network (CNN) was used a dataset of images representing the interface pressure distribution.

AUC revealed interface pressure parameters e.g., contact area, centre of pressure the most accurate in detecting postural changes events (AUC ≥0.6). Internal pressure signals of the air cells at the seat interface, which provide pelvis and thigh support, revealed AUC values ≥0.6. Closer examination of the data highlighted clear inter-subject differences. PCA revealed subject-specific separate clusters indicating the different postures. However, prediction of the static postures with CNN revealed a low accuracy of ~20%. These results can be explained by the automatic adjustments in inflation and deflation of the air cells following postural change events, which compensate differences in pressure points at the seat interface.

Discussion

Our study demonstrated that combination of an optimal dataset of internal and interface pressure parameters and intelligent algorithms have the potential to identify clusters of postures. Our subject-specific findings were the result of the fact that the participants adopted postures in a random order. In addition, the low accuracy of CNN highlighted the capability of Aergo Health technology to compensate for postural asymmetry. These results put the basis for technical innovation where the air cells automatically identify movement patterns and establish support requirements, for comfortable, continuous transition of postural support and proactive relief of pressure points. This can be translated to a variety of clinical situations and vulnerable patients, who require postural support and will aid in the self-management of their posture and mobility.

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9.3 FP3

Development of a robust postural care process of assessment, analysis and implementation to enhance professional practice and student outcomes for students with complex physical disability

Corinne Phillimore, Occupational Therapist and
Anesu Madondo, Physiotherapist, National Star College

An insight into the process of the development and implementation of a multi-disciplinary clinical approach to postural management assessments for students with complex physical disability at the National Star College, in order to improve our service delivery and make impactful application of the data analysis and clinical findings to inform the provision of equipment, therapy programs and onward referrals as required.

I want to encourage and motivate others to see the benefits of making impactful and radical changes to service delivery in order to improve their service provision and efficiency, utilising highly specialist skills and joint working to demonstrate clinical effectiveness to fund holders and offering best practice to service users. This approach to assessment and service delivery can support therapists with equipment prescriptions, therapy programs, swiftly identifying any referrals to other agencies that might be required and resulting in a single document of clinical analysis with recommendations and clinical reasoning completed and justified.

I will share my experiences of developing my own skills by attending the Oxford Centre of Excellence Postural Management Assessment Training course and then building and establishing my skills by using it routinely within a multi-disciplinary team whilst I was working as an Occupational Therapist for the NHS county wide community OT service with particular responsibility in special school. I will describe how I have worked with a modified version of the OCE paperwork in order to streamline the assessment, analysis and action plan coming out of the process.

Following on from this I have subsequently changed jobs – leaving the NHS and moving into the charity sector. I now work in the OT team at the National Star College in Gloucestershire which provides specialist further education, training, personal development and residential services for people with physical and learning disabilities and acquired brain injuries. When I arrived in my new post and looked into the postural care pathway that I had been so used to using so routinely and effectively, to discover that there wasn't one, I soon stepped into place to develop the pathway. For many reasons, the COVID restrictions and the recruitment and retention of staff are probably the major factors, the habit of joint working across therapy teams had lapsed and the notion of completing a full postural care assessment had dissolved under the pressures.

I will go on to describe what I did to encourage and promote the therapy team to embrace the change to their practice as a positive element rather than additional work, how I worked collaboratively to design an assessment framework and postural management assessment pathway for the National Star students and therapy team and the rationale behind the decisions made.

Whilst it may feel like a significantly time intensive investment, our vision is that the beneficial outcomes of this change of working practices in the therapy provision at National Star will be overwhelming. The therapists will build valuable working relationships, we will be able to do away with other smaller bits of work because this rich information has been gathered. An extensive specialist postural assessment will influence the correct prescription of equipment and will ensure that local authority money is well spent, setting up students for adulthood and their transition from college into their local communities which will also take pressure off the local adult team's transition too. A win, win, win all round and a team of professionals with enhanced specialist skills, team working and professional integrity through robust assessment processes and joint working across sectors.

9.4 FP4

Is my in-situ sling dangerous whilst travelling in a vehicle?

Nicola Holbrook, West Midlands Rehab Centre, Birmingham

Objective Measurement of the Impact of Interface Fabrics on Wheelchair Occupant Safety during Transportation in a Vehicle

The safety of wheelchair occupants during transportation in a vehicle is a critical concern. One aspect of this safety is the interaction between the wheelchair occupant and the wheelchair and seating support surfaces. An area that appears to have been overlooked in previous guidance and research is the impact of interface fabrics such as an in-situ transfer sling.

Responses on the PMG Facebook Forum in May and December 2023 highlight at least 7 areas in the UK where transport providers are refusing to transport wheelchair users with a sling in place. This has been impacting wheelchair users across the UK. A patient being stretchered to their wheelchair appointment without their wheelchair would prevent a review from being carried out. In-situ slings are not designed to be removed and refitted whilst in the wheelchair and thus increases the risk of injury to the user from skin abrasion and manual handling injury to the carer. A custom contoured seating system and postural belts and harnesses would be set up to accommodate the in-situ sling. With the sling removed, the fit of the seating would be affected and the postural straps would need to be appropriately adjusted to prevent the well documented risk of injury from incorrectly adjusted belts and straps.

There is currently debate between wheelchair users, wheelchair services and patient transport services regarding the need to protect wheelchair users from injury and harm. Without clear guidance, regulations or standards there is the need to evidence the impact of a hoist sling on the safety of a wheelchair user whilst in a vehicle.

This presentation will share the objective measures that could inform the impact of interface fabrics on wheelchair occupant safety while traveling in a vehicle.

1. An overview of the current state of knowledge on wheelchair safety, interface fabrics, and their effects on occupant safety.

2. The methodology used to objectively measure the impact of different interface fabrics relating to the sliding of a wheelchair occupant during heavy braking.

3. The results of the investigations and discuss their implications for wheelchair occupant safety.

4. Identified areas for further research

In conclusion, we will provide valuable insights into the effect of interface fabrics such as in-situ slings and hope this will be used to inform protocols to improve the safety of wheelchair users.

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10. PLENARY 5 Wednesday 17 July 2024

Location: Ironbridge 1 Chair of the session: Mohamed Mirghany

10.1 PL5.A

Steering-by-Leaning in Manual Wheelchairs

Reto Togni, ETH Zürich

Manual wheelchairs do not have steering systems; instead, the direction of travel is controlled by varying the speeds of the rear wheels [1]. To turn, users can either speed up one side or, more effectively, slow down the other. As a result, moving a wheelchair forward always involves some degree of backward power input and parallel or subsequent energy compensation [2]. Directional control appears to be a largely overlooked source of energy loss, contributing to the inefficiency of wheelchair propulsion, posing a healthcare risk, and causing frustration for users.

Our steering-by-leaning system enables wheelchair users to steer without braking by using a laterally tiltable backrest that acts as a steering wheel [3]. In laboratory comparisons with conventional wheelchair propulsion, we found that the energy required to complete the same agility test course was reduced by more than 50% in some cases, even at higher speeds [4]. This drastically improved energy efficiency was mainly achieved during turning and when moving along surfaces with a sideways tilt similar to that of pavements where, conventionally, wheelchair users are forced to work against themselves to control the direction of travel.

Transitioning from the Lab to daily life, 3 prototypes are currently being tested by users in a series of week-long case trials. Their activities are tracked using portable sensors, and their perspectives are gathered through semi-structured interviews and participant observation. Participants reported significant improvements in personal mobility, highlighting easy one-handed maneuvering, increased trunk activity, and fun factor as key advantages of steering-by-leaning over conventional propulsion.

With these substantial user benefits established, further iterations on the wheelchair systems are needed to ensure good individual fit and overall usability while collaboration with clinicians and service providers is necessary to implement and secure reimbursement for steering-by-leaning systems in manual wheelchairs.

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10.2 PL5.B

Alternative Power Chair controls: a Framework for maintaining independence

Jacob Eltherington, Specialist Rehabilitation Engineer, KCLH, Bowley Close Rehabilitation Centre,
and
Suzannah Shari, Specialist Wheelchair Therapist, GSTT, Bowley Close Rehabilitation Centre, London

Summary

In this presentation we detail the approach that we take towards providing our users with independent mobility. We present the heuristic framework that we apply when considering non-standard methods of driving an electrically powered indoor-outdoor chair (EPIOC). The decision-making process that we took is outlined through the presentation of a case study for the provision of a system for controlling the EPIOC using eye tracking that we undertook in conjunction with our local Assistive Communication Service, the Motor Neuron Disease Association and supplier of the system.

Aims/Objectives

To provide a framework/roadmap by which clinicians can assess a user's functional ability in order to identify an appropriate access methodology so that users can maintain a degree of independent mobility, and self-determinacy.

Background

Wheelchairs have the ability to provide people with independent mobility, in the first instance this comes through manual self-propulsion, however there is a significant proportion of our user group who are either no longer able to self-propel, or who were unable to self-propel in the first instance. In these cases, without clinical and technical intervention the user would be left static and without the self-determinacy to be able to independently mobilise. This is contrary to the Disability and Discrimination Act (1995) (DDA) which lays out that providers of public services should make reasonable adjustments so that an individual's particular disability is not the reason that they cannot access a service (DDA section 20.1.a, 1995). In such cases we consider the provision of an electrically powered, indoor-outdoor chair (EPIOC). Criteria for which generally states that users must be able to operate their chair themselves. In the majority of cases this consists of some form of joystick, however, for those that require additional support, or who are simply unable to operate the joystick we must consider alternative options. This follows the NHS England Model Service Specification for Wheelchair Services (2017) which states that "…users have a wheelchair which allows them to be as independently mobile as their condition allows…".
It is our belief that, in accordance with the DDA, the inability of a user to use a standard joystick should not preclude them from provision of an EPIOC, and that with a holistic, pragmatic, and often experimental, approach we are able to provide bespoke alternative methods of power chair control access. This helps to move us towards being a more equitable service, and serves to enrich the lives of those who would otherwise lose all independent mobility, and to focus on "…quality and whole life costs" of the user, as we know that provision of the correct wheelchair and seating can both drastically improve the quality of life of a wheelchair user, as well as reduce the wider healthcare costs associated with that service user (NHS England, 2017).

Conclusion

We believe that provision of alternative mobility access methods is essential for providing a fair and equitable service. The World Health Organisation International Classification of Functioning Disability, and Health (WHO ICF) describes a model for considering fair access to society, stating that it is not the intrinsic factors of the individual that limit their participation, but rather extrinsic factors of the world around them such as the equipment provided, or not provided, to them that limits their function and social participation (WHO, 2022). The DDA states that cost should not be a reason to not provide a service to a disabled person. Ultimately, the legislation suggests that we have a duty to reduce features of our services which prevent disabled peoples from accessing our services (DDA Section 20, 1995). Although we run a public health service, and therefore must be fiscally responsible and deliver good value to our stakeholders, the benefits of an appropriately prescribed and adjusted wheelchair to provide functional, independent mobility are many and can reduce hospital admissions, the social care burden, and enable disabled people to engage in society to a far greater extent (NHS England, 2017).

We present a roadmap/framework through which we approach alternative control provision, including a set of examples of recent work, and finally a case study example of the first person in the UK to be driving their chair using an eye-tracking system at home.

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- "It is unlawful for a provider of services to discriminate against a disabled person—" "in the standard of service which he provides to the disabled person or the manner in which he provides it to him" "in the terms on which he provides a service to the disabled person" Subsections 19.1, 19.1.c, and 19.1.d
- "for a reason which relates to the disabled person's disability, he treats him less favourably than he treats or would treat others to whom that reason does not or would not apply" – Subsection 20.1.a
- "Any increase in the cost of providing a service to a disabled person which results from compliance a provider of services with a section 21 duty shall be disregarded for the purposes of subsection (4)(e)." – subsection 20.5
- "Where a provider of services has a practice, policy or procedure which makes it impossible or unreasonably difficult for disabled persons to make use of a service which he provides, or is prepared to provide, to other members of the public, it is his duty to take such steps as it is reasonable, in all the circumstances of the case, for him to have to take in order to change that practice, policy or procedure so that it no longer has that effect." - Subsection 20.1
- "Where a physical feature (for example, one arising from the design or construction of a building or the approach or access to premises) makes it impossible or unreasonably difficult for disabled persons to make use of such a service, it is the duty of the provider of that service to take such steps as it is reasonable, in all the circumstances of the case, for him to have to take in order to—
  (a) remove the feature;
  (b) alter it so that it no longer has that effect;
  (c) provide a reasonable means of avoiding the feature; or
  (d) provide a reasonable alternative method of making the service in question available to disabled persons." – Subsection 21.2

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- "*Service users have a wheelchair which allows them to be as independently mobile as their condition allows and take account of social, educational and employment needs."*
- "*The wheelchair allows users to interact with their able-bodied peers, engage in recreation and maintain a healthy lifestyle and prevent secondary health problems*
- *"Service Users feel they have an equal chance to contribute to society and enjoy the physical and mental stimulation that this can provide."*
- "Commissioning should focus on quality and whole life costs."

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11. POSTERS View in Exhibition Hall

11.1 P1

Assessing clinical outcomes of a novel seating approach

Bart Van Der Heyden and **Filipe Correia**, BES Healthcare

Current technologies for managing our client's posture include tilt-in-space, back support recline systems and various after-market back support options. These technologies have benefited our clients for many years; however, seating remains challenging for many clinicians and wheelchair users. This poster will explore the clinical outcomes and biomechanics and user case presentations to understand why we still have unresolved seating challenges for these clients. In addition, there's a consensus that seating postures change during the day depending on tone, postural energy, tasks and preference, however it is hard to provide postural variations for our client with current technologies.

In this poster, we share the clinical results of a new seating concept designed to overcome the limitations of current seating systems. This new postural management system is designed to facilitate spine extension, head position, postural variation and tone changes, while reducing postural fatigue. We look forward presenting this new approach.

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11.2 P2

North Wales Wheelchair service working in synergy with the regional Stroke team in North Wales to improve Early Supported Discharge and patient experience.

Jayachandran Jaganathan, Betsi Cadwaladr University Health Board

Summary

Current stroke guidelines outline the need for community stroke rehabilitation services following transfer home from hospital, including access into residential or nursing homes. NICE strongly recommends the provision of early supported discharge. North Wales Wheelchair service adapted our service delivery pathway to diverse regional stroke team within North Wales.

Aims and objectives

North Wales Wheelchair service in partnership with all three localities in the East, West and Centre stroke service in BCUHB and Bronglais service in HDU health board developed pathway to facilitate early discharge and optimal rehabilitation. Wheelchair service identified barriers and adapted pathway to facilitate seamless transfer at various stages in the stroke care pathway.

- Acute stroke unit (ASU) to Specialist Stroke inpatient rehabilitation (SSIR)
- ASU or SSIR to Early Supported Discharge (ESD)
- ASU or SSIR or ESD to the Community Rehabilitation team (CRT)
- ASU or SSIR or ESD or CRT to End of life care or discharge.

Background

North Wales PAMS Wheelchair service took a pro-active step to engage with all the stroke services within North Wales and had a series of discussions with the respective Stroke team Clinical leads in all the localities. This enabled us to understand their stroke care pathway and the areas that require change or improvement to facilitate:

- Safer accelerated discharge process and reduce length of stay in the hospital by establishing early referral system.
- Seamless transfer of care within the stroke care pathway by establishing fast track standard clinical direct issue system and providing the Stroke team with range of assessment stock Wheelchairs and accessories.
- Patient centred goals and their satisfaction by providing training on postural assessment, wheelchairs and accessories to the stroke team.
- Patient quality of life and their functional outcomes by timely assessment and sensitive provision of equipment and postural support systems.
- Independence and reduction in long-term use of social care.

Wheelchair service identified and prioritised their needs to streamline the service delivery to provide quality care, whilst synergising with the regional Stroke team for them to adhere to the National guidelines when providing stroke rehabilitation.

North Wales PAMS Wheelchair Service have developed the joint working objectives to support regional stroke team:

- PAMS Wheelchair service and Stroke unit to work together to facilitate discharge from the hospital ward or Rehab unit. To facilitate patients' independence in transfers and, or mobility, progress physical abilities, increase their motivation and maximise rehabilitation opportunity through enabling to access different environments.
- PAMS Wheelchair service to provide required stock and training on wheelchairs, cushions and accessories to stroke unit.

- PAMS to maintain an inventory of stock issued. Liaise with approved repair service to repair and maintain the stock.
- Stroke team to assess, trial and adjust appropriate equipment in stock, to use it for therapeutic purpose during patient rehabilitation in the unit.
- Stroke team to refer to PAMS Wheelchair service and provide quality information from the outcome of their assessment trial to help onward progression of assessments with the Wheelchair service.
- Stroke team to ensure that the referral is made in time to facilitate patient discharge.
- Stroke team to ensure not to raise expectations of patients and make them aware that PAMS can take a significant duration of time to assess and handover a Wheelchair and PAMS clinician will assess and prescribe the equipment that best meets their needs.
- Stroke team to be aware of PAMS Wheelchair service process and pathways.
- Stroke team to ensure that their staff members receive most recent level 1 PAMS training.
- One arm drive Wheelchair (OAD)

Wheelchair duty therapist will issue Action 3 with low seat to ground height, low profile cushion and pelvic belt as CDI (clinic direct issue) and will list them for assessment by Wheelchair Therapist to assess and plan the best course of action.

Discussion

The aim of PAMS Wheelchair Service working in synergy with the regional team was to be a catalyst to enhance Stroke care pathway. Clearly, it was evident that the Wheelchair service had a major role at various stages of Stroke Care Pathway. Timely provision of a Wheelchair is one of the key prerequisites for safer accelerated patient discharge and for seamless transition of patient between various settings. Ongoing training and provision of assessment stock to the Stroke team empowered them to provide quality information about patient mobility needs and resulted in improved patient functional outcomes.

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11.3 P3

Quality improvements within the active user pathway

Rebecca Denson and **Janet Wiggins**, Mersey Care NHS Trust

Summary

Liverpool Wheelchair Service has recently reviewed the active user pathway to provide an improved experience for our patients. The purpose of this poster is to share local experience of the key areas the service has reviewed and implemented changes.

Aims and Objectives

- To identify key areas of improvement within Liverpool Wheelchair Service active user pathway and commissioning.
- To share implemented changes and learning the service has experienced to best support the needs of active user patients.

Background

The service completed a review of the current pathway and identified key areas where we could improve upon/ gaps in provision.

Key areas of development identified

1. Improved assessment/ review- greater level of detail due to increased training, knowledge and skills of staff.
2. Use of PWB top up/ notional plus to widen scope of patient choice and access to increased features within active user range and parts.
3. Bespoke adjustments that support improvements/ changes in patient ability to support independence and function. Scheduled reviews.
4. Improvements in stock- to enable bespoke adjustments and supports wheelchair health check by an engineer and immediate repair, reduction in potential for less active loan provision.

The service implemented the above changes to the process to provide an improved experience and outcome for our patients. This included identification of gaps in commissioning, working with suppliers to explore compatibility across product lines and collection of patient feedback.

Discussion

Patient feedback was collated to identify whether changes made to service provision have had a positive outcome for patients. Patient feedback supports the changes made to the active user process. Use of the PWB notional plus/ top up to provide more choice has been a positive experience for patients. It has enabled patients to access better specification of wheelchairs that are still within NHS provision and repairs and has opened up more opportunities to meet all of the patient's health and wellbeing goals, rather than just the clinical goals of prescription.

The pathway review gave the service the opportunity to highlight gaps in current service provision and commissioning, in particular the need for scheduled reviews to support bespoke adjustments and progression of patients function and ability in active user wheelchairs.

Training, knowledge and skills have improved, to support further development across the team, a skills resource is being developed alongside in-house training to share the in-depth knowledge and skills across the team.

Further areas of development planned include exploration of the use of power assist devices. Development of wheelchair skills training and resources for new adult active users to achieve the best functional mobility.

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A visual history of wheelchair design from 500 BC onwards.

Richard Amm, Designer

Summary

This research tracks the historical context, materials and design of wheelchairs from ancient to modern times. This includes wheelchairs in early civilisations, medieval paintings, the Renaissance, and those used by important historical figures and the evolution of designs to the modern era.

Aims and objectives

The purpose of this research was primarily to explore wheelchair designs that would be suitable for low-resource, low-technology environments. The presentation also allows for historical context and identity development which may aid the transition to wheelchair use for new users. The work also draws together a selection of histories which are often only approached in isolation and covers a topic which is broadly underexplored.

Sharing knowledge • Promoting good practice
PMG Posture & Mobility Group

11.5 P5

How does wheelchair set-up effect fatigue development?

Iwan Cole, Betsi Cadwaladr University Health Board

Research aims

1) Investigate which aspects of wheelchair setup affect fatigue development rate

2) Develop quantitative reasoning to inform wheelchair setup.

The author has been unable to find a single definitive comprehensive NHS best practice wheelchair set up guide, as most guidance for wheelchair set-up is condition-specific. For example, NHS England's 'national service model for integrated community stroke services'; calls for the prescription of specialist seating and/or wheelchair support to aid in the recovery and symptom management post stroke (Bircher 2017). NHS health boards / trusts each work to their own wheelchair service specification documents. These include eligibility criteria and scope of practice but do not explicitly state how to set up wheelchairs correctly (North Bristol NHS trust 2017)

NICE (National Institute of Health and Care Excellence) offers guidance on the establishment and operation of a wheelchair service (NHS England 2017) but the author was unable to find specific wheelchair setup guidelines. This trend is also apparent in the documentation provided by the World Health Organisation (WHO) (World Health Organisation 2023)

The International Society of Wheelchair Professionals (ISWP) provide documentation and guidelines for beginner, intermediate and advanced professionals on how to correctly setup a wheelchair. They also provide in-person and online training to educate professionals on correct wheelchair set-up (Frost et al. 2012). ISWP state their training is based on 'best practice guidelines'.

This research aims to add data to support the best practice recommendations made, by testing the extent of their impact on fatigue development.

Methodology

Participants self-propelled an Invacare K-series manual wheelchair over a short distance while wearing a heart rate monitor. The wheelchair was set up by experienced wheelchair therapists to what they believed to be the ideal set up for each individual. The distance they travelled was controlled and the participants kept their speed as constant as possible.

Between each repetition of the distance the wheelchair set up was altered to vary the seat depth, front & back seat-to-ground height around than the 'ideal' set up. The increment used are based on the staged holes provided on the Invacare K-series manual wheelchair.

The heart rate was then analysed and normalised between participants. Clinically significant heartrate changes were noted and outlined. A sensitivity index was then formulated to examine the effect of wheelchair set-up on clinically significant heartrate changes.

Expected results and clinical implications

The study is still ongoing.

It is anticipated that seat depth may have the greatest effect on heart rate, due to the change of centre of gravity (GOC) (IEEE Engineering in Medicine and Biology Society. Annual International Conference (39th: Cheju Island et al. 2017) This shift in COG alters how much resistance participants feel while attempting to push the wheels.

Clinically, this means professionals may want to consider the range of seat depths and/or increment size available on wheelchairs they prescribe.

Expected conclusions

Improper wheelchair set up may negatively impact fatigue development. A change in heart rate based on wheelchair set up alteration could evidence this.

The author currently works as a Clinical Scientist Trainee in NHS Wales, and has no conflict of interest to declare.

Case study for posture and pressure distribution in lying

Michael Gillet, **Gaby Hilman** and **Alice Wintergold,** Sussex Community NHS Foundation Trust

Summary
The poster will present a case study of posture management and pressure distribution in lying.

Aims
The aim of the case study was to compare pressure distribution in lying between a standard pressure relieving mattress and the Jenx® Dreama lying support.

Background
It is important for children with complex neurodisability to have a uniform pressure distribution when sleeping at night time to prevent tissue damage. Significant pressure difference across the body can lead to tissue breakdown and serious consequences. 24-hour Postural management interventions highlight the importance positioning including at night time (Nice 2016).

Method
This was a single case study of a child with complex neurodisability. The young person in the case study was a 15-year-old girl with a diagnosis of cerebral palsy GMFCS level 5. She has significant learning difficulties, ongoing respiratory symptoms with recurrent chest infections, difficulties with communication, is gastrostomy fed, and has epilepsy. Prior to this study the child was sleeping on a pressure relieving mattress in supine. For this case study we measured pressure in two lying positions and between two different surfaces. We compared pressure distribution in the supine and side lying positions on a standard pressure relieving mattress and on a Jenx® Dreama using the BodiTrak pressure mapping system. This system uses a mat with sensors placed under the body to measure pressure distribution across the body.

Results
We found that there was a more uniform pressure distribution around the greater trochanter area on the Jenx® Dreama than the standard mattress. Similar pressure relieving qualities were identified in both pieces of equipment for supine lying.

Conclusion
Identifying higher pressure gradients is essential for identifying effectiveness of postural management systems. This case study supported the use of one postural management system for this particular child. Pressure mapping may be an important aspect of lying support provision for children with complex neurodisability who are at risk of tissue damage.
For the purpose of this case study a Dreama was lent to us by Jenx®

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The use of Moulded Seating Inserts in North Wales PAMS

Ella Mencel, North Wales Posture and Mobility Service

Summary

This work sets out an audit of current clinical practice within the North Wales Posture and Mobility Service to understand how Moulded Seating Inserts (MSIs) seating systems are used.

Aims and Objectives

The objectives are:

- Define current understanding of the benefits of MSIs
- Understand the population of MSI users
- Record the observed clinical benefits of MSI
- Understand points of failure in the supply and use of MSI

Background/Technique/Standards/Clinical Detail/Results and Testing

The North Wales Posture and Mobility Service provide Custom Contoured Seating in the form of an 8mm ABS shells with a 1" Evazote liner (total system is commonly referred to as a Moulded Seating Insert / MSI or Derby Seat outside of the service) as an alternative to Carved Foam Seating.

There is limited literature which reflects on the use of MSIs for complex postural needs, and minimal published research or evidence to support the benefits stated, (qualitative or quantitative). MSIs are advertised by suppliers to be stronger and more durable than foam, lighter, and have a more slimline aesthetic than carve foam seating. They are also reported to maintain their shape better against force over time, resulting in a tighter fitting shape. However, they are more difficult to adjust once manufactured and there are less options available for fitting pressure relieving materials.

In 2019, an in-house retrospective study was completed by one clinician to review feedback from 14 seats MSI seats supplied in the previous year. Feedback from 8 adults and 6 paediatric patients was reviewed. 9 had a primary diagnosis of Cerebral Palsy, but other diagnoses included Spina Bifida, Multiple Sclerosis, and Mitochondrial Deletion. In over 50% of these cases there were qualitative repeated observations recorded in clinical notes of a decrease in upper body muscle tone, increase in functional upper limb use, and favourable reports of comfort with no unexpected problems. In three cases, there were incidents including a pre-existing pressure sore developing increased redness, sliding resulting in increased skin redness, and a mounting bracketry failure. All were resolved with modifications to existing seating; none changed to an alternate style seat.

This study was completed by one clinician on seats supplied by themselves, so unconscious bias will be present in the collection and processing of feedback. Information collected is unable to account for how MSI seating systems work across a variety of casting techniques and manufacturing process. Additionally, these seats were provided after a 7-year hiatus, from the service in manufacturing ABS moulds, and the data collected over 1 year so no long-term information about seats could be collected.

Going forwards, work will be done to understand how MSIs have been used in the service over the last 5 years, provided by both an in-house team and external contractors. Information will be collected on the patient population the seating has been provided to, adverse incidents after supply, replacement plans, and reported benefits.

Discussion

There is a lack of evidence within literature to support the current opinion of MSIs for managing posture – benefits are often anecdotal and singularly reported. The 2019 study has laid the foundations to understanding how ABS moulds are used within the North Wales PAMS. This work intends to collate information to provide a better sense of current clinical practices within the service and help to identify research areas for the future.

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How good are silicon/gel sheets at protecting bony landmarks from pressure damage?

Ahmed Daub, Essodeke Karan (Swansea University) and **Mark Bowtell**, Rehabilitation Engineering, Swansea Bay University Health Board

Aims and objectives

This study scopes current understanding on the performance of thin substrate materials *(Chen et al., 2002; Duffy, 1990)* and considers methods to quantify their performance for the purpose of pressure distribution and skin protection. It proposes a basic test method and performs comparative bench testing of these substrates using load testing. The study aims to provide insight for the clinical use of silicon/gel sheets in protection of skin damage under bony landmarks.

Background

Silicone and gel sheets are used within various wheelchair and seating applications and beyond for protection of pressure injury *(Agarwal et al., 2011; Sparks et al., 2015)*. The local service is increasingly using silicone sheets as part of pressure ulcer prevention solutions, to protect vulnerable spines in children for example.

There is a lack of literature about the properties of such materials in terms of compliance, pressure distribution, shock absorbance or resilience *(Akaishi et al., 2010; Wiseman et al., 2019*). We are left to make assumptions about how they perform and how they compare to other materials, such as foam, for posture and mobility applications.

Method

An indenter is used to mimic elbow, ischial tuberosity or spinal process. Known loads are applied, appropriate to those seen in sitting, using a quantifiable loading device. Compliance of the silicone sheets will be determined, as a proxy for immersion. Different thicknesses will be reviewed, and comparisons made with different materials.

Secondary questions might answer, through repetitive loading, the robustness of the materials, assessing degradation, failure or 'bottoming out'.

Results

The first test examined the immersion characteristics of KerraPro compared to Dermisplus. The research also examines the impact of thickness on immersion and the compliance of Gelovation gel and Action Gel compared to silicone sheets. The results reveal a plateau in immersion, suggesting a limit on the amount of displacement achieved by Kerrapro gel.

The Kerrapro gel showed higher displacement per unit force than Dermisplus gel, despite having the same thickness of silicone. The thickness of the sample also affected immersion levels, with thicker Kerrapro gel showing higher levels. However, the observed rise in immersion is less than expected, suggesting a non-linear profile influenced by density or composition. Gelovation gel and Action Gel showed superior compliance compared to silicone sheets, possibly due to inherent physical characteristics.

Discussion

Independent verification and testing are important to the field of posture and mobility. Rehabilitation Engineering services are well placed to support this activity. The current project has provided valuable scoping of such activity and furthered our knowledge of practical, clinically relevant testing methods of thin substrates, and provided fundamental insight to the efficacy of silicone sheets in relation to other materials.

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The development of manual wheelchair user skills test

Adam Reuben, Birmingham Community Healthcare NHS Trust

Summary

To provide a robust skills assessment to support clinicians' choice of a manual wheelchair to best meet the needs of their service users' abilities and goals.

Aims and Objectives

The aim of the development was to introduce a manual wheelchair skills test that could be used to help assess users' ability, implement their goals, and aid clinical decision making. Implementing this test and signposting to training can help users become more independent and confident in using their wheelchair.
The skills test gives objective measures that support clinicians' clinical reasoning when prescribing manual wheelchairs.
The skills test is linked to the service's prescription guidelines to ensure that service users are given the most appropriate wheelchair to meet their current and emerging skills without compromising safety.

Background

Part of my engineering project when I was a trainee RE was to understand the characteristics of an "active user" wheelchair and understand the biomechanics of functional tasks in order to preserve upper limb function and help reduce long term, wheelchair related injuries. Like many services, service users often perceive that an 'active user' chair meets their needs due to being lightweight and thus easier to manoeuvre. However, the research I have undertaken demonstrates that there are many factors that affect the manoeuvrability of manual wheelchairs and that these can be explored with the service user alongside their skills in order to meet their goals.

The development of an active user skills test is directly linked to an ongoing piece of work undertaken by Birmingham wheelchair service where we have prescription guidelines that are evaluated annually. Wheelchairs, from a basic manual wheelchair to an active user chair, are put into a "decision tree". The skills that service users demonstrate are linked to the selection of the chair to meet the service user needs based on our objective assessment in clinic and service users' goals.
A training guide for clinicians has also been developed in order to ensure that they can correctly demonstrate / instruct how to perform certain skills, for example going up and down a kerb.

Discussion

The skills assessment is there to provide an objective guide to support clinicians in equipment selection to ensure that they have the knowledge and consistency in equipment provision for this user group. I would welcome discussion of the skills assessment nationally at the conference to continue to adapt and develop it into a robust objective measure when prescribing manual wheelchairs.

12. CPD REFLECTION SHEET

Use this page to help reflect on the conference sessions you attended

Sessions attended
What did I hope to learn when booking to attend PMG2024?
How do the sessions attended fit into my training needs/CPD?
Key learning points achieved
What is the most important outcome from attending PMG in terms of addressing current and future learning needs?
How will my learning influence or change my clinical practice?

13. PERSONAL NOTES