ISPO UK MS ANNUAL SCIENTIFIC MEETING

25 & 26 September 2015
St Hugh's College, Oxford

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WELCOME TO THE 43rd ISPO UK MS ANNUAL SCIENTIFIC MEETING

Dear Delegate

We are delighted to welcome you to the ISPO UK MS conference at St Hugh's College, in the University of Oxford. St Hugh's was founded as a women's college with just six students in 1886; men were admitted for the first time 100 years later. The college is named after St Hugh of Lincoln. It is renowned for its extensive and beautiful 14 acres of gardens. During the Second World War it was requisitioned for use as a hospital for head injured soldiers, establishing its long links with rehabilitation. Famous former students include Nobel Peace Prize winner Aung San Suu Kyi and current UK cabinet ministers Theresa May and Nicky Morgan. The newest building is close to the conference centre, the Dickson Poon China Centre. We hope you will enjoy looking around during breaks in the conference programme.

The major themes of our conference include presentations on themes linked to areas of expertise in Oxford: Evidence Based Medicine (and how this can be applied to prosthetics and orthotics) and Neuroplasticity and phantom pain, with presentations on research being carried out here in Oxford at the Functional MRI of the Brain centre at the John Radcliffe Hospital. The Blatchford Lecture will be given by a distinguished guest, Professor Bengt Soderberg, from Sweden, continuing the theme of evidence building in prosthetics. We are pleased too to have presentations from Oxford surgeons working jointly with prosthetic services to improve functional outcomes for amputees.

We are looking forward to a special conference dinner in the St Hugh's dining room, with a mystery guest to entertain us, and to renewing old friendships in the convivial atmosphere of the special conference bar afterwards

On Saturday we have parallel programmes for prosthetics and orthotics, before we reassemble as one group for a final session looking into the future of our clinical work – we are delighted to welcome Professor Chockalingham from Staffordshire University, who will be giving the OETT Lecture and talking about advances in human movement analysis. Our final talk is by another distinguished guest, Professor Ed Lemaire, who joins us from Ottawa in Canada, and who will be speaking on a subject close to all our hearts – *'Can your smartphone make you smarter?'*

There are free paper sessions covering a wide variety of topics, and some excellent posters – please take the time to view the posters during the breaks, and have a chat with the authors if you can.

This meeting could not take place without the support and sponsorship of the commercial companies, so please do ensure that you take time to visit the exhibition stands and engage with our exhibitors. Thanks are extended to our Platinum Sponsor - Opcare, Gold Sponsor - Ottobock, Silver Sponsor - Irwin Mitchell and Bronze Sponsor - Allergan Pharmaceuticals and supporter, North Sea Plastics. Their sponsorship contributes enormously towards this high quality meeting.

If you are not dashing away from the conference at the end, we recommend seeing Oxford from the vantage point of the open top buses, which are a great way to see this beautiful city. You can catch the buses from many points around the city centre, and get on and off repeatedly so you can visit interesting sites; they stop at the railway station if you are heading away by train.

We hope you enjoy the conference!

Dr David Henderson Slater
ISPO UK MS Scientific Chair - 2015

Dr Lal Landham
Chair, ISPO UK MS

CONFERENCE PROGRAMME

Friday 25 September

All plenary sessions will take place in Maplethorpe Hall.

0930 **Welcome – L Landham, Chair ISPO UK MS**
Free Paper Session (4 x 15 min presentations plus 2 x 5 min presentations)

0935 "The effect of electromagnetic shielding on phantom limb pain: a placebo controlled double blind crossover trial"
Dr K Fisher, Royal National Orthopaedic Hospital, Stanmore

0950 "Can cognitive assessment predict lower limb prosthetic success?"
Dr V Kalansooriya, Musgrave Park Hospital, Belfast

1005 "A Cross Centre Study of Timed 'Up and Go' Test Results"
G Campbell, Musgrave Park Hospital, Belfast

1020 "Measuring Service Quality in Prosthetics: an evidence base for continual improvement"
D Hannett, Opcare Ltd, Oxfordshire

1035 "Van Nes Rotationplasty – a retrospective study of two patients"
Dr L Graham, Musgrave Park Hospital, Belfast

1040 "Five minutes can make a difference: a narrative analysis exploring amputees experiences of support and community reintegration"
U Pabbineedi, Manchester Metropolitan University, Manchester

1045 **Exhibition & Refreshments**

1115 **<u>Neuroplasticity, pain and the use of prostheses</u>**
Chair - Prof R S Hanspal
"What neuroplasticity tells us about rehabilitation in prosthetics and orthotics"
Professor Heidi Johansen Berg, University of Oxford

1205 "Functional MRI of the brain in amputees: what we have learned so far"
Associate Professor Tamar Makin, University of Oxford

1255 Discussion/questions

1300 **Exhibition & Lunch**

1400 **<u>Working with surgical colleagues to improve prosthetic outcomes</u>**
Chair - Prof J Kulkarni
"Limb lengthening to enable prosthetic use"
Mr Martin McNally, Consultant Orthopaedic/reconstructive surgeon, Honorary Senior Lecturer, University of Oxford with Caroline Ward, Deputy Prosthetic Manager, Oxford

1445 "Refashioning stumps – a Plastics' perspective"
Mr Alex Ramsden, Consultant Plastic Surgeon, Oxford

1530 **Annual General Meeting, Exhibition & Refreshments**

1600 **<u>Evidence based practice in prosthetics and orthotics</u>**
Chair - Dr David Henderson-Slater
"An introduction to Evidence-Based Medicine: what it can do – and what it can't"
Dr William Herrington MD MRCP (UK) MBBS, Nuffield Department of Population Health, University of Oxford

1645 **Blatchford Lecture (introduced by Prof R S Hanspal)**
"Building an evidence base in prosthetics: the Swedish experience"
Professor Bengt Soderberg, Sweden

1735 **Company Presentations**
Irwin Mitchell LLP

1930 **Drinks Reception & Conference dinner in St Hugh's Dining Room**

Saturday 26 September

Parallel sessions for prosthetics and orthotics will take place from 0900 – 1230 hrs.
A final combined plenary session will be held in Maplethorpe Hall from 1230 hrs – 1415 hrs.
Refreshments will be served in the Foyer during the extended break from 1030 – 1130 hrs.

0900 **Prosthetics Session (Maplethorpe Hall)**
Chair: Michael O'Byrne, Opcare Ltd

Free Paper Session (4 x 15 min presentations plus 6 x 5 min presentations)

0905 "Use of gait lab 3D motion capture for dynamic assessment of amputee socket interface biomechanics with validation using TRIPS sensors systems – a case study"
J Tang, Student, University of Southampton

0920 "Investigation into the effect of liner choice on interface stresses using a stump/socket simulator"
Dr M McGrath, Research Fellow, University of Southampton

0935 "Effects of clinical interventions and everyday activities on dynamic loading at the lower limb stump/socket interface"
P Laszczak, Student, University of Southampton

0950 "Quantifying Residual Limb Shape after Transtibial Amputation with a Statistical Shape Model"
J Steer, Student, University of Southampton

1005 "Pre-amputation assessments at West Midlands Rehabilitation Centre – 12 months review with patient feedback"
Dr P Ramamurthy, West Midlands Rehabilitation Centre, Birmingham

1010 "Appraisal of foot and ankle amputations"
Dr A Tarall-Jozwiak, Queen Mary's Hospital, London

1015 "Outcomes following Trans-Femoral Amputation – Review of consecutive Trans-Femoral amputees referred to Regional Amputee Rehabilitation Service"
Dr P Ramamurthy, West Midlands Rehabilitation Centre, Birmingham

1020 "A case study quantifying stump/socket interface stresses of lower-limb amputees"
Dr J Gao, University of Southampton

1025 "Assessing Prosthetic Knee Control Systems: Fluidics vs Electronics"
J Boender, Oxford

1030 "Bariatric amputee: A growing problem?"
S Purcell, Specialised Ability Centre, Manchester

1035 **Exhibition & Refreshments**

1135 **"The Three National Prosthetic Policies for Multifunction Hands, Microprocessor Knees and High Definition Silicon Covers – an update and discussion"**
Chair -Prof R S Hanspal
Guest Speaker: Col A Mistlin, Consultant in Rheumatology & Rehabilitation, DMRC Headley Court, and Chair NHS Clinical Reference Group

Company Presentations

1205 Opcare Ltd
1210 Ottobock Healthcare plc
1215 Allergan Limited

1220 "Update on the progress of the Upper Limb Assessment Outcome Measures group"
Professor Peter Kyberd, *University of Greenwich, London*

1235 Comfort break/Regroup for Final Plenary Session in Maplethorpe Hall

0900 **Orthotics Session (Maplethorpe Seminar Room)**
Chair - Steve Seccombe , Chas A Blatchford & Sons Ltd

Free Paper Session

0905 "The use of amCube Footwork Pro pressure plate in the tuning of ground reaction orthosis: a case study"
G Dunn, Leicester Specialist Mobility Centre, Leicester

0920 "Can a partial off-loading Ankle Foot Orthosis improve function and reduce pain following ankle injury?"
P Durkin, Northern General Hospital, Sheffield

0935 "Identification and management of tibialis posterior tendon dysfunction in primary care"
N Gallogly, Royal Berkshire Foundation Trust Hospital, Reading

0950 "Gait correction using Functional Electrical Stimulation"
Guest Speaker: Lynn Vale, Clinical Specialist, Ottobock Healthcare plc

1035 **Exhibition & Refreshments**

1135 "The effect of 'tuning' in ankle-foot orthoses on the gait parameters of children with cerebral palsy"
Guest Speaker: Dr Nicola Eddison, Staffordshire University

1230 Comfort break/Regroup for Final Plenary Session in Maplethorpe Hall

1245 **Final Plenary Session (Maplethorpe Hall)**
Chair – Prof S Zahedi, Vice-Chair ISPO UK MS

OETT Lecture:
"Technical and Scientific Advances in Human Movement Analysis – the role of the technician and that of a clinician"
Professor Nachiappan Chockalingam, Staffordshire University

1330 "Using Smartphones to Enhance Clinical Decision-making: Can your phone make you smarter?"
Guest Speaker: Ed Lemaire, Professor of Physical Medicine and Rehabilitation, University of Ottawa, Canada

1410 Presentation of prizes, conclusion of conference - L Landham, Chair, ISPO UKMS

1415 Light lunch and departures

POSTER EXHIBITION

"Evaluation of Therapy Pre-Amputation Consultations at the Royal National Orthopaedic Hospital"
C Owen, Royal National Orthopaedic Hospital, Stanmore

"The Use of Socket Comfort Scores as an outcome measure: a multi-centre study"
P Taylor, Musgrave Park Hospital, Belfast

"A six month review of outcomes for people undergoing major lower limb amputations from a single centre in South East London. Do different pathways mean difference outcomes?"
J Georgiou, Guys and St Thomas' Hospital Amputee Rehabilitation Unit, London

"An Instrumented Toy for Hemiplegic Cerebral Palsy Children"
S A Mutalib, Imperial College London

"A scoring tool to predict functional outcome in lower limb amputees (BLARt) – a pilot study"
H Naylor, Leicester Specialist Mobility Centre, Leicester

"Stance phase timing difference in patients using hydraulic ankle units"
R Moore, Luton & Dunstable Hospital, Luton

"Does using the Foot Scanner speed up the delivery of bespoke footwear at Northern General Hospital?"
C Bailey, Northern General Hospital, Sheffield

"A qualitative assessment of the effects of the Avalon hydraulic ankle for Multiflex foot users"
R Moore, Luton & Dunstable Hospital, Luton

"The effectiveness of using Microprocessor-controlled knee joints for lower limb amputees"
A Wright, Blatchford Clinical Services, Sheffield Teaching Hospitals NHS Foundation Trust

"Van Nes Rotationplasty – a retrospective study of two patients"
Dr L Graham, Musgrave Park Hospital, Belfast

"Five minutes can make a difference: a narrative analysis exploring amputees experiences of support and community reintegration"
U Pabbineedi, Manchester Metropolitan University, Manchester

"Appraisal of foot and ankle amputations"
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J Boender, Oxford

"Bariatric amputee: A growing problem?"
S Purcell, Specialised Ability Centre, Manchester

GUEST SPEAKERS

Professor Heidi Johansen Berg is the Director of the FMRIB Centre, and a Wellcome Trust Senior Research Fellow at the University of Oxford. She head the FMRIB Plasticity group whose work focuses on how the brain changes with learning or with recovery from damage such as stroke. The group uses cutting edge neuroimaging techniques to monitor brain change and then uses the information gained to design and test novel rehabilitation interventions.

Tamar Makin is an Associate Professor at Oxford University's neuroimaging centre (FMRIB Centre) at the Nuffield Department of Clinical Neuroscience. Her research group studies the consequences of arm amputation on human brain plasticity. Tamar completed an MSc and a PhD in Neuroscience at the Hebrew University of Jerusalem (Israel). She joined the FMRIB Centre in 2009, first as a Newton International Royal Society Fellow and subsequently as a Marie Curie Intra-European Early Career Development Fellow. She currently holds a Wellcome Trust/Royal Society Sir Henry Dale Fellowship.

Martin McInally is a full-time consultant specialising in limb reconstruction. He has a special interest in limb injury, particularly fractures which do not heal or have healed in a poor position. He also leads a specialist team which runs the only dedicated bone infection unit in the UK. Martin trained principally in Northern Ireland and has spent periods of study in Germany, Canada, England, Russia and the USA. He has a strong interest and record in teaching and research. He holds the degree of Doctor of Medicine and has published over twenty papers on fracture care, orthopaedic surgery and the complication of injury and limb surgery. He serves on the faculties of several international teaching programmes and is also an active member of the British Orthopaedic Association and the British Limb Construction Society.

Caroline Ward graduated from Salford University in 2000 with a degree in Prosthetics & Orthotics. She worked in Birmingham before moving to Oxford in 2007. She is currently Assistant Prosthetic Manager and her clinics involve working with both upper and lower limb amputees. Caroline has been closely involved in the creation of prosthetic prescribing guidelines in Oxford, reviewing evidence to update guidance for prosthetic provision as evidence emerges to inform clinical decision making. She has presented at several conferences including SPEEAD and Attend on a variety of subjects including trans-tibial amputee rowing and prosthetic socket comfort scores.

Alex Ramsden

Alex Ramsden graduated from Glasgow University in 1996, completed his general surgical training in Newcastle upon Tyne and after a two-year period of research at the Restoration of Appearance and Function Trust (RAFT) was awarded his MD from the University of London. He worked for the British Antarctic Survey and spent a year in Antarctica providing medical cover to a large team of scientists. A period of specialist plastic surgical training followed in London and North East England with successful completing of his CCT and FRCS (Plast) fellowship examination.

A hugely rewarding fellowship was undertaken at the Royal Melbourne Hospital supported by a bursary from the British Association of Plastic and Reconstructive Surgeons. He studied all aspects of microvascular reconstruction for one year.

He has worked in the Nuffield Orthopaedic Centre since 2010. Mr Ramsden has a busy practice in all aspects of hand and plastic surgical emergencies, bone infection, microvascular reconstruction and elective hand surgery.

Dr William Herrington is Honorary Consultant Nephrologist at the Oxford Kidney Unit and Senior Clinical Research Fellow, Renal Studies Group, Clinical Trial Service Unit and Epidemiological Studies Unit, University of Oxford.

Bengt Soderberg is a Certified Prosthetist Orthotist, and Research Assistant at the Skane University Hospital, Sweden. He is also Director for the National Swedish Quality Register, Swedeamp. He is a former President of the ISPO Sweden and ISPO International. Bengt's professional and research interests include prosthetic interfaces/suspensions and socket technology, movement analysis within prosthetics and orthotics; new orthotic designs through carbon fiber technology, partial foot amputation prosthetics, amputation and prosthetic national registers and global co-operation for assistive health technologies.

Col Alan Mistlin qualified from Guy's Hospital in 1989 and undertook his pre-registration in London. He has served in Germany, Northern Ireland, Aldershot, Africa and the Caribbean. He returned to hospital medicine in 1994 and carried out rotations in Rinteln, QEMH Woolwich, Frimely Park, The Royal Brompton, Musgrave Park and Bosnia. He commenced training in Rheumatology and Rehabilitation Medicine in 2007 and gained CCST in 2003. He was appointed a Consultant at DMRC Headley Court in 2003 and has worked as the consultant lead to Spines and Neuro-Rehabilitation Group. He was previously Officer Commanding Medical Division and consultant lead to the Complex Trauma and mild Traumatic Brain Injury Group. He was appointed Military Clinical Director at DMRC in April 2012 with clinical responsibilities to complex trauma and mTBI. He was appointed Chair of the CRG for CDE in 2015.

Professor Peter Kyberd has a degree in Science from Durham and a Masters and a PhD in engineering from Southampton University. During the 1990's he worked at the Oxford Orthopaedic Engineering Centre. From 2000 to 2003 he was a lecturer at Reading University and in 2003 he took up a Canada Research Chair at the Institute of Biomedical Engineering, University of New Brunswick, Fredericton. In July 2015 he became the head of the Engineering Science Department of Greenwich University in the UK. Peter has worked in many aspects of engineering connected with orthopaedics, he has a significant interest in in the design, control and clinical application of computer intelligence to create advanced prosthetic arms.

He was on the organising committee of the ISPO World Congress in Vancouver in 2007, was the chair of the Myoelectric Controls (MEC) Symposia at the University of New Brunswick in 2005, 2008 and 2011. He is the Scientific Chair of the Trent International Prosthetic Symposium 2016, and on the organising board of the ICORR conference in rehabilitation robotics to be held in London in 2017.

Lynn Vale graduated as a Physiotherapy from the University of Southampton in 2000. Following her rotations she specialised in neurology, in both the acute and rehabilitation settings within the NHS. Her primary interest is the use of rehabilitation technology and how advancing technology in the field can be used to promote and enhance the recovery of individuals suffering from a CNS pathology or disease. In 2009 Lynn went work as Clinical Specialist for a company dedicated to Functional Electrical Stimulation (FES), working with technology that offers solutions to treat both upper and lower limb paralysis secondary to CNS pathologies. She then went on to develop experience in the Rehabilitation exoskeleton sector, working with Spinal Injury units across the UK and Europe providing training and clinical support.

Lynn is now a Clinical Specialist for Ottobock in the field of surface neurostimulation. She provides education and clinical support for FES in the UK for both the private and NHS sectors, with the objective of promoting awareness of FES technologies to both health professionals and individuals who may benefit from the technology.

Nicola Eddison is the clinical lead orthotist at the Royal Wolverhampton NHS Trust. She is part of the research team at Staffordshire University and is currently undertaking a PhD in biomechanical optimization of ankle foot orthoses and footwear combinations on children with Cerebral Palsy.

Nachiappan Chockalingam is a Chartered Engineer and a Chartered Scientist and the Professor of Clinical Biomechanics at the Faculty of Health Sciences, Staffordshire University where he directs the Biomechanics Facility and leads the Biomechanics team. He is also an Affiliate Professor at the Faculty of Health Sciences, University of Malta and a Visiting Professor at Sri Ramachandra University, India. His research interests span the general area of biomechanics and gait analysis with a special interest in Spine/ Scoliosis, foot and footwear biomechanics.

Prof Chockalingam currently leads several research projects in the area of understanding the design, manufacture and clinical intervention using orthoses, including a large European Union funded research project on Diabetic Foot and Footwear looking at the development of an integrated system for foot assessment.

He has examined several postgraduate and doctoral students and has supervised numerous students to completion. He has numerous publications in peer-reviewed journals, book chapters, and is on the editorial boards of a number of international journals, including Prosthetics and Orthotics International and the Foot.

Ed Lemaire received a PhD in Bioengineering from the University of Strathclyde (Glasgow) and an MSc in Biomechanics from the University of Ottawa. In addition to academic appointments in the Faculty of Medicine and Health Sciences, Dr Lemaire is a member of the Ottawa-Carleton Institute for Computer Science and the Ottawa-Carleton Institute for Biomedical Engineering. He is past President of the Canadian National Society for the International Society for Prosthetics and Orthotics (ISPO) and serves on the ISPO International Scientific Committee.

ABSTRACTS (in order of presentation)

Title: **The effect of electromagnetic shielding on phantom limb pain: A placebo controlled double blind crossover trial**

Presenter: Keren Fisher, Consultant Clinical Psychologist, Dr.
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Other Authors: Sarah Oliver, Assistant Psychologist, Chelsea and Westminster Hospital, London
Dr. Imad Sedki, Consultant in Rehabilitation, Royal National Orthopaedic Hospital
Professor R Hanspal, Consultant in Rehabilitation, Royal National Orthopaedic Hospital

Background
Environmental electromagnetic fields (EMFs) are known to influence biological systems and evidence suggests these have a role in the experience of phantom limb pain (PLP) in patients with amputations. Protection from environmental EMFs may reduce PLP.

Objectives of study
This paper replicated a previous study intended to investigate the effect of EMF shielding with a specially designed prosthetic liner.

Methods
The design was a randomised placebo controlled double blind trial in which participants recorded daily mean and maximum pain, wellbeing, activity limitation due to PLP and time the prosthesis was worn on pre-printed diary sheets for three 2- week periods. These were baseline, then verum (experimental) (VL) and visually identical placebo (PL) liners, which were randomly allocated.

Subjects
21 suitable participants with transtibial amputations, phantom pain at least 1 year with no other treatable cause or pathology took part in the study.

Results
Six participants discontinued the trial because of skin reactions to the silicon liner. One patient died so the remaining 14 completed protocols prevented adequate power to identify all potential differences in the results.

Nevertheless, although here was no statistically significant difference on any variable between VL and PL, the results showed maximum pain and wellbeing were statistically significantly improved from baseline under VL conditions, but not PL. More participants improved on the variables of mean pain and maximum pain, wellbeing, activity limitation and time worn with verum than placebo. There was no difference between the results of those participants who had VL before or after PL, so the order of presentation did not affect the outcome and no carry over from VL to PL occurred.

Conclusion
EMF shielding produced beneficial effects relative to placebo. There is evidence to suggest this might be due to protection of vulnerable nerve endings from enhanced calcium ion influx into the CNS or other biological effects on endogenous analgesic systems.

Title **Can cognitive assessment predict lower limb prosthetic success?**

Presenter V Kalansooriya, Specialist Trainee in Rehabilitation Medicine Belfast, Dr

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Other Authors: L Graham, Consultant Rehabilitation Medicine, Musgrave Park Hospital Belfast Trust

Objectives:
Previous studies have highlighted that cognitive impairment is more prevalent among persons with lower limb amputations than in the general population[1]. Rehabilitation after lower limb amputation requires both physical and mental ability and one study suggests that poor cognitive function can lead to poor outcome in mobility with prosthesis at 6 months[2]. With increasing population longevity and the rise in the incidence of Diabetes Mellitus it is likely that amputees with poor cognition are going to become more frequent attenders for assessment for prosthetic use at amputee rehabilitation centres.

In this study our **aim** was to explore if a particular score on recognised cognitive assessments could predict mobility, especially failure to mobilise with a prosthesis.

Methods:
All patients who attended the Regional Disablement Service, Musgrave Park Hospital over a period of 2 years (January 2013 - April 2015) who were noted on initial assessment by the multidisciplinary team to have cognitive issues and subsequently had a formal cognitive assessment, were included in this retrospective study. These patients had either a prosthesis made or a trial of walking with a PPAM aid or Femurette. Following chart review of these patients' demographics, co-morbidities, MoCA / Addenbrooke's cognitive assessment scores, SIGAM and Timed Up and Go (TUG) outcomes were recorded.

Results:
30 patients were identified and from this group 22 patients had Montreal Cognitive Assessment (MoCA) and 8 patients had Addenbrooke's cognitive assessment administered during limb fitting and gait training. The mean age of the patients was 73.33 years (SD=7.82). 66.6% of the sample was male.
76.6% had a trans-tibial amputation while 23.4% had a trans-femoral**.**
96.6% had PVD as the cause of amputation.
20% of the patients were deemed unsafe for continued use of a lower limb prosthesis or PPAM aid (SIGAM A) and walking training had been aborted. This group had a mean MoCA of 15.6(n=3, moderate cognitive impairment) and mean Addenbrooke's of 45.6(n=3).
Those patients who were deemed safe to use a prosthesis 24 (80%) (SIGAM B upwards) had a mean MoCA of 20.57(n=19, moderate cognitive impairment) and mean Addenbrooke's of 68.6(n=5). Variance and Standard deviation was calculated and means of both SIGAM A and SIGAM B/C/D groups were compared, the difference was not significant at p=0.05. There was no trend with TUG and MoCA or Addenbrookes.

Conclusion:
Patients with a mean MoCA of 15.6 or a mean Addenbrooke's of 45.6 were more likely not to succeed in walking, however this was not statistically significant. A greater number of patients will allow a more in depth study of this subject.

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[1] Cognitive functioning in persons with lower limb amputations: a review.
Coffey L1, O'Keeffe F, Gallagher P, Desmond D, Lombard-Vance R.

[2] Memory and executive function predict mobility rehabilitation outcome after lower-limb amputation.
O'Neill BF1, Evans JJ

Title: **A Cross Centre Study of Timed "Up and Go" Test results.**

Presenter: **Gavin Campbell, Prosthetic Manager**

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Other Authors: Rachael Gaynor, Alan Gordon, Ruth Nicholson, Sioned Steventon

Background:
The Timed "Up and Go" Test has become a commonly used outcome measurement tool in clinical practice and its use is recommended by BSRM, BACPAR and NHS England for new service specifications. Clinicians are therefore required to have a better understanding of its significance and results in practice.

Aim:
The aim of this study was to report on Timed "Up and Go" Test results, in collaboration with other centres, gathered in a clinical setting for unilateral transtibial and transfemoral amputees. Findings from results would provide benchmark data that would assist clinicians to assess amputee mobility and turning performance in relation to other variables, for instance SIGAM grades, cause and level of amputation, age and gender.

Method:
Four UK centres, collected data from random inpatients and outpatients (n=115) attending Rehabilitation centres. Unilateral transtibial (n=81) and transfemoral (n=34) amputees were assessed using the Timed "Up and go" Test during their visit. The subject's SIGAM grade and other specified variables were also recorded.

Results:
The Timed "Up and Go" Test showed significant difference ($p<0.001$) between amputation due to trauma (n=34) and dysvascularity (n=56) in line with other studies. The mean Timed "Up and Go" Time (18.06 and 22.66 seconds respectively) for transtibial and transfemoral levels showed 23% variance.
A good negative correlation was observed between Timed "Up and Go" Test and SIGAM with significant differences ($p<0.001$) between Da(n=6), Db(n=17) and Ca(n=11), Cb(n=9).
Age had a positive correlation with the largest percentage difference between mean results (39%) in Timed "Up and Go" Test times occurring in the 65 to 69 year group.
Gender (male n= 91 and female n=24) had no impact on Timed "Up and Go" Test results, mean age Test for both was 59 years and 19.4 seconds.

Discussion & Conclusion
The Timed "Up and Go" Test shows good reliability in a clinical setting and proved to be consistent with other results published. Additional information gathered on specified variables, subject's age, gender, cause and level of amputation and SIGAM grade classification demonstrated their influence on test results.

Title: **Measuring Service Quality in prosthetics – an evidence base for continual improvement**

Presenter: Dominic Hannett BSc (Hons) Director of Clinical Services – Prosthetist – Opcare
Robert Chatfield MBA BSc(Hons) Managing Director - Opcare

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Measuring patients' satisfaction with the service they receive is of increasing importance in the NHS. No standardised instrument exists for this purpose, and a wide variety of instruments and techniques have been tried, including patient satisfaction surveys, one-off questionnaires etc. This paper describes the use of an academically validated service quality measurement instrument called SERVQUAL (Parasuraman et al 1988) to assess the amputees' experience at the Oxford Centre for Enablement, and the extent of their satisfaction with the service they received.

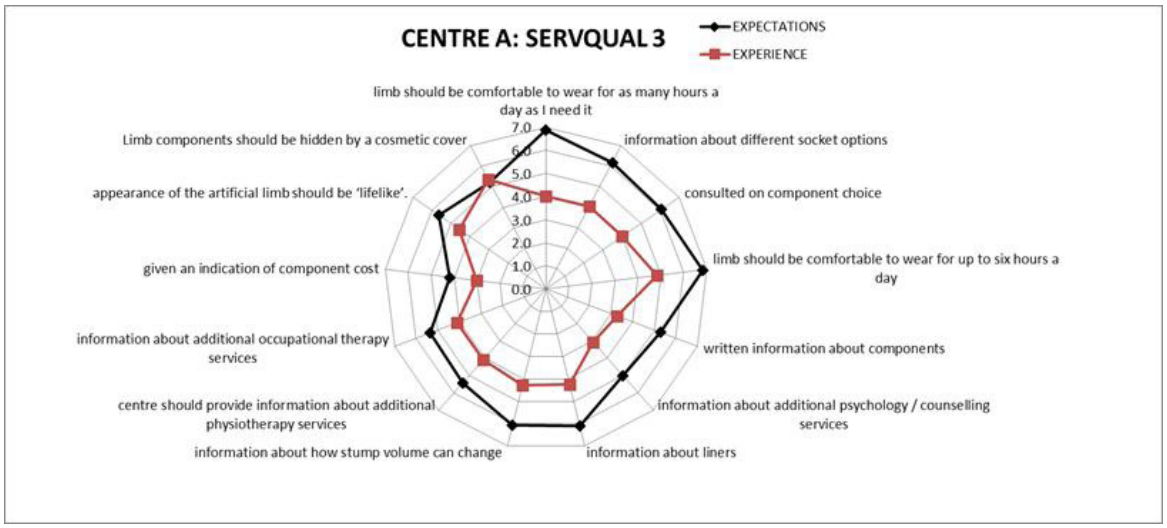
SERVQUAL was developed in the late 1980s, to assess customer satisfaction, in industry and the service industries (Parasuraman, Zeithaml and Berry). The fundamental concept underlying SERVQUAL is that the customer (client, patient etcetera) has an expectation of the service quality they should receive. 'Service Quality' is broken down into a number of dimensions, such as 'tangibles', 'assurance', 'responsiveness' and the questionnaire addresses each dimension with a number of questions.

SERVQUAL allows **expectations** to be compared with **experience** (perception), and allows a comparison to be made between the priorities set by customers, and their ultimate degree of satisfaction. Opcare has undertaken this survey model with over 4000 service users in the UK, allowing benchmarking and targeted service improvement. 4000 surveys were sent out with over 2500 responses across ten separate services across the UK. The top 5 gaps in these centres were remarkably consistent as shown below.

CENTRE A	CENTRE B	CENTRE C	CENTRE D	OXFORD	CENTRE E	CENTRE F
TREATMENT OPTIONS	INFORMATION ABOUT ADDITIONAL SUPPORT	LIMB COMFORT	LIMB COMFORT	LIMB COMFORT	LIMB COMFORT	TREATMENT OPTIONS
INFORMATION ABOUT ADDITIONAL SUPPORT	LIMB COMFORT	TREATMENT OPTIONS	TREATMENT OPTIONS	TREATMENT OPTIONS	TREATMENT OPTIONS	LIMB COMFORT
LIMB COMFORT	TREATMENT OPTIONS	COSMESIS	INFORMATION ABOUT ADDITIONAL SUPPORT	INFORMATION ABOUT ADDITIONAL SUPPORT	INFORMATION ABOUT ADDITIONAL SUPPORT	INFORMATION ABOUT ADDITIONAL SUPPORT
WAITING MORE THAN A WEEK	ACCESS TO EXPERT MEDICAL CARE	INFORMATION ABOUT ADDITIONAL SUPPORT	INFORMATION ABOUT MANAGING PROSTHESIS	QUALITY OF MATERIALS	COSMESIS	QUALITY OF MATERIALS
ACCESS TO EXPERT MEDICAL CARE	COSMESIS	QUALITY OF MATERIALS	QUALITY OF MATERIALS	ACCESS TO EXPERT MEDICAL CARE	QUALITY OF MATERIALS	ACCESS TO EXPERT MEDICAL CARE

At the Oxford Centre for Enablement we then took the top 5 gaps as illustrated above and explored each one in a subsequent survey. A third survey was done in 2014 to address the top 5 gaps from the second survey, meaning Oxford is the only centre in the country with results of three iterations of this model. The results enable us to isolate and define those areas of service quality which are of concern to users and implement action plans to address them.

The results of SERVQUAL 3 are shown below. The major gaps relate to limb comfort and information for patients. As a result a management information system to provide bespoke information to patients about their limb and treatment has been implemented in the centre. Opcare and the NHS have invested in new technologies to improve socket comfort and support users in terms of wider services available.



Title: **Van Nes Rotationplasty – a retrospective study of two patients**

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The Van Nes Rotationplasty is an uncommon surgical orthopaedic procedure allowing the use of an ankle joint in place of an underdeveloped or poorly functioning knee. It can allow the patient a better cosmetic appearance - with ability to restore a "knee"centre, where there is gross femoral shortening, in keeping with the height of the sound side knee centre. Some studies also suggest less energy expenditure and smoother gait with a rotationplasty as compared with a Symes amputation.[1] The Van Nes Rotationplasty is usually performed on children who have a diagnosis of Proximal Femoral Focal Deficiency however in more recent years it has been used for adults who have tibial or femoral sarcoma.

The aim of this study is to present an established 33 year old female patient with a Van Nes Rotationplasty for over 18 years and a 3 ½ year old male patient who has recently undergone a Van Nes Rotationplasty 6 months ago. Both patients have a diagnosis of Proximal Femoral Focal Deficiency.

Techniques: physical examination, radiology and serial video and 3 Dimensional Vicon Gait Analysis have benchmarked their range of joint movements and walking parameters.

Results
The child has more favourable hip development on x ray. Both adult and child have a well developed foot with 90 degrees plantar flexion available for adult and 70 degrees available for child on the affected side. Serial video captures the child's initial use of the new prosthesis and at follow up 6 months later – improvements in "knee flexion" on Van Nes side and speed of walking are evident. Video and Gait analysis captures the lateral trunk bend, poorer weight transference to prosthetic limb on stance, lack of "knee" bend due to apparent derotation and "knee" centre now lying more internally rotated in the adult patient.

Conclusion The long term issue of derotation for Van Nes Rotationplasty is evidenced in the adult patient. Lack of "knee" bend now and reduced symmetry of walking may have implications for the future. The child post Van Nes has had restoration of level knee centres and shows improving ability to bend "knee" and crouch down.

Reference

1. Fowler EG, Hester DM, Oppenheim WL. Contrasts in gait mechanics of individuals with proximal femoral focal deficiency: Symes amputation versus Van Nes rotational osteotomy. *J Paediatr Orthop* 1999;19:720-731

Title: **Five minutes can make a difference: Anarrative analysis exploring amputees experiences of support and community reintegration post limb loss**

Presenter: Uma Pabbineedi, BSc (Hons) Psychology, Miss
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Limb loss can be a difficult experience for the amputee and can also affect their family and social system. This is a qualitative study which aims to explore the challenges amputees face when reintegrating into the community. This study also examines the ways in which they can be supported in terms of social and psychological support to ensure successful reintegration which can maximise their independence. Six participants were interviewed using semi-structured interviews lasting for one hour each. Interviews were recorded and subjected to narrative analysis. Narrative analysis was performed according to the guidelines outlined in Crossley's (2000) six analytic steps. From this three significant themes emerged; A different life, 'they all rallied round' and 'it's all from books'. Participants discussed the challenges they faced within their family, in their surrounding environment and in a social context.

Findings from this study provide an enhanced understanding of how psychological / social support such as counselling and peer support groups can help prior to and following amputation. The need for professionals to consider the amputee within a context was also highlighted. From the participant's feedback a model of support was constructed, highlighting the key types of support amputees would benefit from. Examples of these include; support groups, buddy schemes and sporting facilities. In conclusion both psychological / social interventions such as counselling and peer support groups may play a vital role in the rehabilitation process in addition to routine care. Perhaps future training for health and allied professionals should incorporate disability awareness training.

Title: **What neuroplasticity tells us about rehabilitation in prosthetics and orthotics**

Presenter: Professor Heidi Johansen-Berg
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This presentation will introduce the concept of neuroplasticity and provide background to neuroimaging Methodology, including FMRI. Examples will be given of how these methods can be used to study adaptation. Of relevance to the fields of prosthetics and orthotics, discussion will be held on how FMRI can be used to study how changes in limb use, or use of prostheses, leads to alterations in FMRI activity over time.

Title: **Functional MRI of the brain in amputees: what we have learned so far**

Presenter: Associate Professor Tamar Makin
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Following arm-amputation, a person faces overwhelming challenges to adapt to their daily routine. Simple everyday tasks, such as lacing shoes, become a tremendous challenge, which amputees have to learn to overcome single-handed. Their brain, too, will undergo major changes. Brain areas that previously operated the hand will become unemployed, and will subsequently be “recruited” to work for other body parts. This ability to dynamically reassign processing responsibilities to a certain brain area based on changing circumstances (termed ‘plasticity’) is key for our basic ability to adapt to new situations. In amputees, this process is widely held to result in the experience of phantom limb pain (pain that is perceived to be arising from the missing hand), and is therefore considered to be maladaptive. This presentation will introduce evidence to challenge the proposed link between cortical reorganisation and phantom pain, and instead demonstrate that plasticity in amputees can be adaptive. Based on this evidence, it is suggested that plasticity in amputees is experience-dependant, and is not inherently maladaptive.

Title: **Limb lengthening to enable prosthetic use**

Presenters: Mr Martin McInally MD FRCS Ed, FRCS (Orth)
Consultant Orthopaedic Surgeon in Limb Reconstruction

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Fitting a prosthesis to an amputee with a short residual limb can be very challenging. This presentation looks at the considerations and surgery involved in lengthening the residual limb. It includes a case study of a trans-femoral amputee who underwent residual limb lengthening at the Nuffield Orthopaedic Centre and outlines pre and post-operative prosthetic usage.

Title: **An introduction to Evidence-Based Medicine: what it can do – and what it can't**

Presenter: Dr William Herrington MD MRCP (UK) MBBS
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Over the past 15 years, the Renal Studies Group at Oxford University's Clinical Trials Support Unit has conducted research into the causes, prevention and treatment of chronic kidney disease (CKD) and its complications. This includes the SHARP trial, which recruited 9,400 CKD patients from 18 countries. As Consultant in Renal Disease, Will Herrington works also on evidence based methods of research aiming to improve patient care and the effective use of health resources. His research interest is to ensure future randomized trials incorporate streamlined methods in order that they remain large enough to answer clinical questions reliably, whilst remaining cost-effective and feasible.

Blatchford Lecture 2015

Title: **Building an Evidence base in prosthetics: the Swedish experience**

Presenter: Bengt Soderberg, CPO
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Swedeamp – a national quality register for amputations, prosthetics and rehabilitation – was introduced in Sweden in 2011. As of today, more than 3000 have been recorded in Swedeamp. The inclusion criteria are amputation and the patient is followed until death.

Sweden had around 33-37 amputations per 100,000 inhabitants during the period 1998 – 2012. The Average age for women is 75 and men 68.

The aim of introducing a national database was to harmonise the treatment in the whole of Sweden, there previously being big variations within the country. A second aim is to highlight ways to improve the whole service and promote a team approach.

The system allows cost benefit analysis to be carried out on all steps of the service including the prosthetic fitting.

Swedeamp consists of six forms, which are filled online:-

- Personal patient data
- Amputation data
- Prosthetic data
- Data of the situation for the patient before amputation
- Data of the situation for the patient 6, 12 and 24 months after amputation
- Movement analysis data

The presentation will cover how Swedeamp is implemented and include data and figures for 2014.

Title: **Use of gait lab 3D motion capture for dynamic assessment of amputee socket interface biomechanics with validation using TRIPS sensors systems – A case study**

Presenter: Jinghua Tang, PhD Student, Mr

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Introduction: Current development of above-knee amputees' sockets is heavily influenced by the conceptualised movement of the femur within the soft tissue of the stump and the resulting pressure distribution. Additional knowledge on the three-dimensional (3D) coupling between residuum and socket could be used to aid socket design, fitting and provide a functional prosthetic acceptable to the amputee. A novel approach[1] using 3D kinematic motion capture system was developed to quantify the degree of 'socket joint' motions. In this work, the 3D motion method is clinically validated by using tri-axial pressure and shear (TRIPS) sensor system[2] at the residuum/socket interface.

Method: The case study involved an amputee with a knee-disarticulation who was monitored along a gait walkway using a 3D motion capture system. The signals from 3 TRIPS sensors located at anterior-proximal, posterior-proximal and anterior-distal regions of the stump were simultaneously recorded during the walking trials. The 3D motion measurements were then used to construct a residuum/socket interface biomechanical model in order to estimate the angular and axial coupling at this critical residuum/socket interface. The model consists of a Virtual Residuum Segment (VRS) and Socket Segment (SS). 3D Carden angles between the two segments were calculated which represents the angular coupling in three quasi-anatomical planes. Axial coupling, conventionally termed 'pistoning', was calculated as the distance between the hip joint centre and the prosthetic knee pivot centre. Interfacial TRIPS sensor signals provided indications of residuum motion at socket interface and this could be subsequently compared with the angular and axial coupling profiles obtained from the 3D motion capture analysis.

Results and Discussion: On average, approximately 12° of VRS angular motion was observed in quasi-sagittal plane relative to SS. During stance phase, the VRS began to engage with the posterior socket wall before returning to its original position in swing phase. Similar trends was also recorded with the TRIPS sensors, demonstrating an enhanced contact pressure on posterior proximal region of the stump when compared with the value recorded at the anterior proximal region. Up to 4° of angular coupling was evident for both quasi-coronal and quasi-transverse plane. Axial coupling was found to range between 20-35mm in this case study. Indeed, the VRS was shortened during the stance phase and restored its axial position during the swing phase. A similar profile was evident in the value of the axial shear stress measure at the anterior distal region of the stump.

Conclusion: A new residuum/socket interface biomechanical model was validated by using sensors at the residuum/socket interface, which provide real time measurements of the dynamic stress profile. The case study indicates that the biomechanical model can be used to assess the socket joint motion supported by data derived from appropriately located TRIPS sensors. The quantified degree of socket joint motion may also offer insight into the quality of socket fit and limb control.

References

1. Tang J, Jiang L, Bader DL, et al. Use of gait lab 3D motion capture for dynamic assessment of amputee socket interface biomechanics – A preliminary study. *ISPO World Congress* Lyon 2015.

2. Laszczak P, Jiang L, Bader DL, Moser D and Zahedi S. Development and validation of a 3D-printed interfacial stress sensor for prosthetic applications. *Med Eng Phys*. 2015; 37: 132-7.

Title: **Investigation into the effect of liner choice on interface stresses using a stump/socket simulator**

Presenter: Michael McGrath, Research Fellow, Dr

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Introduction
Prosthetic liners are widely used amongst lower-limb amputees. Some provide extra comfort for the user, while others play a physical role in socket suspension. Despite their prevalence, there is still a lack of a consensus on how best to quantify the quality of a liner and to match its performance to the specific needs of an individual amputee. This challenge could be achieved using a lower-limb stump/socket interface simulator with appropriately located measurements of interface stresses. A range of liner variables were examined in this *in vitro* study.

Method
A stump/socket interface simulator was constructed to provide a control simulator for testing in a research lab setting. It was based on two loading conditions that use uniaxial compression to produce the kinetics of the *'weight acceptance'* and *'heel-rise'* phases of walking. Unlike previous tests, which assume a rigid stump/socket coupling, an artificial transtibial stump was developed, which used silicone to provide a homogenous approximation of human soft tissues, producing a more representative stump and hence a realistic interface loading profile.
A tri-axial pressure and shear (TRIPS) sensor system[1] was used to evaluate the interface stresses at key load bearing regions of the artificial stump.
Different liner variables were investigated to examine the effects of, for example, the presence of a pin lock on the performance of a custom liner. Additionally, the effects of friction between the liner and the stump on the measured interface stresses, were assessed.

Results and Discussion
When using the simulator, measured interfacial pressure and shear stresses correlated well with reported values[2]. The variability of the simulator measurements were often close to, or less than, those observed for the real amputees. This suggests the simulator offers a more reproducible method for studies to compare prosthetic components.
No notable difference was observed when comparing the pin-lock liner to the cushion liner, although the analysis was restricted to stance phase loading. Nonetheless, we observed that the friction between the stump and the liner can affect the interface loading profile. In addition, the relative magnitudes of pressure and shear were demonstrated to vary across the different regions of the stump.

Conclusion
A stump/socket interface simulator was designed and built to provide a reproducible representation of the stump loading profile during key gait events, in a laboratory setting. Interfacial pressure and shear, as a function of liner choice and stump/liner friction, have been studied using this simulator. The results suggest that the friction between the stump and the liner is a key element in the distribution of interface stresses.

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2. Sanders JE, Lam D, Dralle AJ and Okumura R. Interface pressures and shear stresses at thirteen socket sites on two persons with transtibial amputation. *Journal of rehabilitation research and development*. 1997; 34: 19-43.

Title: **Effects of clinical interventions and everyday activities on the dynamic loading at the lower limb stump/socket interface**

Presenter: Piotr Laszczak, PhD student, University of Southampton, MEng

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Introduction

Every day amputees perform a wide spectrum of activities, including ambulation across different terrains[1], which are taken into consideration by prosthetists during initial fittings and subsequent adjustments. These adjustments would be predicted to affect the dynamic loading at the stump/socket interface. A unique Tri-axial Pressure and Shear (TRIPS) sensor system was recently developed[2] which is able to measure three directional load magnitudes at the prosthetic interface. This was used to assess performance of a single subject during a range of activities.

Method

The TRIPS sensor system[3] was employed on a knee disarticulation amputee and stump/socket interfacial loading in normal (pressure) and tangential (shear) directions to the stump were measured. The subject was requested to perform various activities, typically experienced in everyday life. Different clinical interventions, such as adjustments of foot spring settings were trialled and their outcomes, in terms of interface loading, were measured.

Results and Discussion

The results showed highly repeatable loading patterns for all activity types. Significant differences in peak loads and their timings, as well as loading patterns, were observed for various foot settings. The effect of clinical interventions on the different activity levels was assessed. Those activities which posed the most risk of compromising the amputee's comfort were identified. For standing and level walking, the pressure values were comparable to previous studies. However, no direct comparaison to shear values was available in the literature.

Conclusions

Effects of clinical interventions and everyday activities on the dynamic loading at the lower limb stump/socket interface was investigated with a unique TRIPS sensor system. Key differences in peak interfacial stresses and their timings between different settings of prosthetic components were identified. The findings provide valuable insight into the effects of the clinical interventions on the dynamic nature of socket loading and the biomechanics of the critical stump/socket interface. The study outcomes may constitute a foundation for future research towards the effects of adjustment of prosthetic components on the stump/socket coupling.

References

1. Zahedi S. Lower limb prosthetic research in the 21st century. *Atlas of prosthetics* 2001.
2. Laszczak P, Jiang L, Gao J, et al. Tri-axial pressure and shear (TRIPS) sensor system for stump/socket interface. ISPO World Congress Lyon 2015.
3. Laszczak P, Jiang L, Bader D, et al. Development and validation of a 3D-printed interfacial stress sensor for prosthetic applications *Med Eng Phys* 2015; 37: 132-137.

Title: **Quantifying Residual Limb Shape after Transtibial Amputation with a Statistical Shape Model**

Presenter: Joshua Steer
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Background: Successful prosthetic adoption is reliant upon safe and comfortable residuum-socket interface. This interface is strongly dependent on shape and quality of the residual limb. Quality is defined using residuum shape, bone shape and skin condition factors [1]. Prosthetists may measure residuum volume and gross anatomic dimensions during prosthetic socket design, and higher resolution measurements can be extracted from residuum scanning [2].

Aims: This study aimed to use high resolution scanning technology to measure transtibial residual limb shape and use statistical modelling techniques to demonstrate shape variation across a southern UK population in current rehabilitation.

Methods: 62 rectified casts of transtibial residual limbs were scanned using a VIUScan (Creaform, Canada) laser scanner, with local ethical permission (13/NW/0833). A MATLAB (Mathworks, USA) programme was written to process the scans for creation of an anatomic statistical shape model (SSM). Principal Component Analysis (PCA) was used to reduce the dimensionality of the data into a limited number of optimal components. These are used to determine features of shape variation that could be used to quantify differences within the population. The model was interrogated in order to determine how many PCs were required to adequately represent the shape. This was done by considering a variance threshold of 95%; a Leave-One-Out test and recreating the original training shapes with a limited number of modes.

Results: The PCA model was able to successfully reduce the dimensionality of the data to create a number of PCs, which could be described by clinically significant geometrical labels (Figure 1).

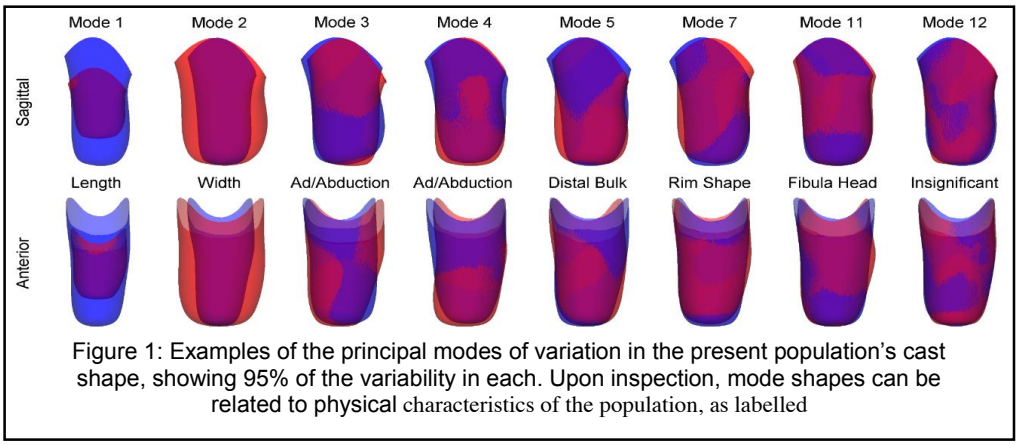

Figure 1: Examples of the principal modes of variation in the present population's cast shape, showing 95% of the variability in each. Upon inspection, mode shapes can be related to physical characteristics of the population, as labelled

When the model was interrogated it was seen that the shape variation in the population was adequately described by a reasonable number of PCs. The variance threshold of 95% required 49 PCs while sub-mm geometrical accuracy was achieved after 20 PCs for the Leave-One-Out Cross Validation test and after 30 PCs when recreating the training data. The study's main limitation is that the PC analysis was conducted using scans of rectified residuum casts, instead of the residuums themselves. Therefore, the residuum shape is confounded somewhat with the prosthetists' casting and rectification process.

Conclusions: This study has described a technique to use data acquired from high resolution scanning technology to capture the shape of the residual limb and perform quantitative analysis upon the population through use of a SSM. The SSM was able to represent adequately the population using a limited number of PCs. Further research is needed to evaluate the associations between residuum shape and clinical outcomes. This would provide an evidence base which would contribute to decision support as part of best practice across the clinical pathway, from surgery to rehabilitation.

References:
[1] Persson & Liedberg 1983, POI
[2] Dickinson, Steer, Woods & Worsley 2015, JRRD (In Press)

Title: **Pre amputation assessments at West Midlands Rehabilitation Centre – 12 months review with patient feedback**

Presenter: P Ramamurthy, Consultant Rehabilitation Medicine

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Aim:

Pre-amputation assessment is a fundamental phase of Amputee Rehabilitation. Referrals for pre-amputation assessment have increased. We wished to study the value of comprehensive patient assessment.

Method:

We reviewed Pre-amputation assessments over a 12 month period (April 2014 – March 2015) considering source of referrals, preceding medical history, and outcomes. Patient feedback using a purpose-designed Patient Satisfaction Questionnaire (PSQ) was requested.

Results:

28 patients were referred for assessment (21 by Orthopaedic teams – mechanical trauma the original cause in 14). Of all patients assessed, 11 were advised amputation at appropriate level for potential functional gain; 6 were advised against amputation (likelihood of poor outcome with little or no functional benefit). 4 were advised orthotic management. The remaining 7 received advice regarding choice of options.

12 completed PSQ with overall satisfaction score of 100%. At the time of study, 6 of 11 patients advised amputation had proceeded and commenced prosthetic rehabilitation. 1 of 6 patients advised *against* amputation had undergone amputation with no functional benefit.

Conclusions:

Increasing referrals from Orthopaedic teams usually relate to long-term complications or failed salvage surgery. Pre-amputation assessment can further advise regarding appropriate level of amputation, skin flaps, and value of delayed primary closure – with the objective of improving functional outcome from prosthetic rehabilitation.

Patients find the assessment beneficial, preparing them for their rehabilitation process on a well-informed, positive note with realistic expectations. Furthermore, it facilitates effective pre-emptive care co-ordination and rehabilitation planning. Therefore, it should be mandatory in all patients where amputation is an elective treatment option.

Title: **Appraisal of foot and ankle amputations**

Presenter: Dr Aurelie Tarall-Jozwiak,
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Aims and objectives:
Transverse (transmetatarsal) and longitudinal (ray) amputations in the forefoot result in less morbidity, good weight distribution and restoration of near normal gait pattern with appropriate orthotic management. The common indications are diabetic foot infection and septicaemia.
Tarsometatarsal (Lisfranc) and midtarsal (Chopart) amputations when carried out in carefully selected patients with skilled surgery and can be treated successfully with ortho-prostheses. A muscle balancing procedure is crucial to avoid deformities. It provides a good option of management for diabetic patients with limited mobility goals.

According to statistics, less number of ankle disarticulation (Syme or modified Syme) are performed in the recent times. Accordingly, surgical and prosthetic skills and experience are becoming limited. In the last couple of decades, there has been a vast improvement in prosthetic technology of transtibial prosthesis compared to continuing challenges of providing Syme prosthesis. Younger patients, and especially women, complain about its cosmetic aspect which could also contribute to its fall out.

Method of study:
- Analysis of national and local centre statistics
- Literature research

Conclusion:
- Referrals to Queen Mary's Hospital in 2010-2011: 4 partial foot amputations versus 81 transtibial amputations (respectively 91 and 2944 nationally).
- Studies suggest less energy consumption, higher functional outcome and equivalent quality of life of transtibial versus partial foot amputations.
- Forefoot amputations are successfully treated with bespoke orthotics and have a place in diabetic foot management. At Queen Mary's Hospital, 34 partial feet (31 patients) were treated between October 2013 and April 2014. 13 were treated in the prosthetics department, 21 in orthotics.
- Mid-foot amputations warrant careful assessment and the surgeon should perform muscle balancing procedure to avoid secondary deformity.
- Syme amputation is performed less frequently. It is surgically and prosthetically challenging.
- Pirogoff and Boyd amputations have a place in the management of congenital deformities. It provides a durable stump for partial end bearing with PTB prosthesis.
- Based on literature and our experience, for a young patient with prospect of high activity, a transtibial amputation is preferred to mid or hind foot amputation as there is a wider choice of prosthetic components with better functional results.
- Transmetatarsal amputation is known to have a lower mortality rate than transtibial amputation. Morbidity and mortality of mid and hind foot amputation is similar to transtibial amputation. Partial foot amputation has a place in carefully selected patients with limited disease and mobility expectation.
- Multidisciplinary orthotic, prosthetic and diabetic team assessment is beneficial prior to recommending a level of amputation.

References:
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Partial foot amputation in patients with diabetic foot ulcers. Brown ML, Tang W, Patel A, Baumhauer JF. Foot Ankle Int. 2012 Sep;33(9):707-16

Title: **Outcomes following Trans-Femoral Amputation - Review of consecutive Trans-Femoral amputees referred to Regional Amputee Rehabilitation Service**

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Aim:
There appears to be an increase in the age of elderly and dysvascular patients with associated co-morbidities undergoing Trans-Femoral amputation who do not have the physical reserve required to mobilise with prosthetic replacement. The purpose of this study was to look at outcomes following Trans-Femoral amputation in this group.

Methods:
We reviewed a consecutive series of patients referred to the regional centre who had undergone Trans-Femoral amputation during 2013. There were a total of 129 patients, 16 patients were excluded from the study (13 - aged below 65 years, 2 - out of area, 1 - rotationplasty)

Results:
Of the 113 patients aged 65 or above, 29 patients (26%) were recorded as having died by the time of study. At initial assessment, only 15 (13%) patients were considered sufficiently medically fit and potentially able to derive some functional benefit from prosthetic replacement and 69 (61%) patients were advised against using prosthetic replacement as part of their overall rehabilitation. 4 (27%) of the 15 patients who underwent prosthetic rehabilitation had abandoned prosthetic use by the time of study.

Conclusions/Recommendations:
In the elderly dysvascular group of patients who underwent Trans-Femoral amputation only 10% (11/113) were using prosthetic replacement in some functional capacity – none of whom walked outdoors beyond their curtilage (SIGAM ‘C’). This emphasises the need for timely assessment and management of wider rehabilitation needs of this significantly increasing number of amputees who will not benefit from prosthetic replacement, with appropriate collaboration of acute hospital services, rehabilitation services and social services.

Title: **A case study quantifying stump/socket interface stresses of lower-limb amputees**

Presenter: Jianliang Gao, PhD, Dr

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Introduction: Socket fit is critical to ensure successful prosthetic outcome. An ill-fitting socket may lead to discomfort, pain or even deep tissue injury. Furthermore, amputees typically suffer from co-morbidities such as diabetes, peripheral vascular disease *etc*., which can exacerbate these problems[1]. Accordingly, compensatory strategies are employed to self-regulate the socket fit by wearing different layers of socks to improve comfort. The value of this practice in terms of changes in quantitative stresses at the stump/socket interface, however, remains unknown.

Method: Three tri-axial pressure and shear (TRIPS)[2] sensors were deployed on the key load bearing regions at the stump/socket interface using a single male knee articulation amputee. The pressure and shear measurements of each region were collected. Level walking tests were performed at walking speeds of 0.5 step, 1 step and 2 steps per second each with a particular number of socks worn over the stump. This protocol was repeated with the number of plies of socks added or removed as a manner of altering socket fit. Mean peak values and timing were analysed to understand the effects of socket fit on the load distribution over the key load bearing regions at the interface.

Results and Discussion: Differences in both the magnitude and timing of the mean peak values of pressure and shear at each of the chosen regions were evident with socket fit. By adding more socks, increase of pressure and shear in the different regions was not proportionally similar, and vice versa. At each load bearing region, the magnitude of pressure was higher than the corresponding value for shear. The effect of adding or removing socks on the pressure was also more significant. The change in pressure profiles varied more in the proximal brim regions than the distal region when more socks were added or removed. Walking speed was also shown to always affect the mean peak values and timings, independent of the number of socks being worn.

Conclusion: The case study provides quantitative evidence of the load distribution changes when different numbers of socks are worn on the stump. The results can give a guideline for how to most appropriately balance the load at the stump/socket interface. Consequently, this approach can minimise the risk of developing tissue damage on the residual stump.

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Title: **Assessing Prosthetic Knee Control Systems: Fluidics vs. Electronics**

Presenter: Jacob Boender, Technical Director / Prosthetist, Mr

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In an *independently conducted* Clinical-Crossover study by Schüling et al., the performances of a Fluidic vs. MPK controlled knee function were found to be significantly similar, contrary to the researcher's expectations. Schüling et al. compared subjective and objective outcomes of 21 participants that used all four knee joints to control for variations between individuals. However, the technical details that support and explain the comparable performance were out of scope of their study, therefore it is difficult for the reader to assess *how* and *why* Fluidic Control can achieve similar results, (and in some cases offer better) than MPK's in supporting prosthetic knee control.

In order to support clinicians with operational understanding of their chosen prescription, our *own* research aims to provide clarity of understanding with respect to the requirements in prosthetic knee control, and how to observe and test for prosthetic knee control with respect to certain qualities e.g: what makes good *stance yielding*, controlling swing via resistance-dependent motion vs. motion-dependent resistance, how does a vortex metering system enhance stumble recovery, the sampled vs. real time control.

Stance yielding has been studied with respect to variations in operating temperature as well as the range of continued support during progressive knee flexion. Motion-dependent resistance is the desired mode of control. Sampled stepper motor control has some drawbacks relative to real time vortex metering. Vortex metering uses non-mediated dynamic negative feedback from the flow through the valve to compensate for both pressure and viscosity supporting sustained performance over a wide range of temperatures and variation in load bearing.

The fluidic swing phase control is on par with the industry standard MPK knee in that there is a pre-set desired swing motion, that through negative feedback alters resistance to progressing swing flexion in accordance to need, and even deals well with a single out-of pattern swing move.

It has been found that the vortex metering system stabilises the in-vitro stance yielding against viscosity changes not seen in an industry standard non-MPK reference joint, and this is supported by patient experience in down-slope duration testing. The vortex metering system also provides instant stance yield resistance in case of stumble recovery, free of delays due to any digital sampling.

From our work, and in conjunction with Schüling's results, it can be concluded that there is both clinical evidence as well as engineering evidence that supports clinical outcomes, and this evidence can be broken down into procedures that a practitioner can use in evaluating technology performance.

From this work it would be essential that independent studies are made, to remove the suspected bias inherently associated with our research, and to support demystification of prosthetic knee control, so that the practitioner will fully understand their prescription to their patient.

References:

Schüling S et al., Knee Joints with Controlled Flexion Damping for Transfemoral Amputees in a Clinical Cross-Over Study: C-leg, Rheo Knee II, VGK, Orion. *Münsteraner Schriftenreihe zur Technischen Orthopadie* 2013; ISBN 978-3-86523-240-3, Schüling Verlag, Münster

Title: **Bariatric amputee: A growing problem?**

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Background:
This study reviewed prevalence of patients with lower limb amputations with above normal weight profile, with body mass index over 25, in seven disablement services centres managing their amputee rehabilitation in the United Kingdom.

Objectives:
To review two clinical standards of practice in amputee rehabilitation. Ambulant lower limb amputees should have their body weight recorded on an electronic information system, with identification of cohort with body weight >100 kg. Lower limb amputees to be provided with suitable weight-rated prosthesis.

Study design:
Observational study of clinical practice.

Methods:
Data were collected from the Clinical Information Management Systems. Inclusion criteria – subjects were ambulant prosthetic users with some prosthetic intervention in the last 5 years and had at least one lower limb amputation. We studied over 15,000 amputation subjects.

Results:
In 96% of patients, the weight record profile was maintained. In addition, 86% were under 100 kg, which is the most common weight limit of prosthetic componentry. Of 15,204 amputation levels, there were 1830 transfemoral and transtibial sites in users with body weight over 100 kg. In 60 cases, the prosthetic limb build was rated to be below the user body weight.

Conclusions:
In 96% of our patients, body weight was documented, and in 97%, the prosthetic limb builds were within stated body weight limits, but this may not be the case in all the other disablement services centres in the United Kingdom. Also, the incidence of obesity in the United Kingdom is a growing problem, and the health issues associated with obesity are further compounded in the amputee population.

Clinical relevance:
Prosthetic componentry has distinct weight limits which must be considered during prescription. As people with amputation approach the limits of specific components, clinicians are faced with the challenge of continued provision in a safe and suitable manner. This article reviews the amputee population and the current national profile to consider trends in provision and the incidence of these challenges.

Title: **Update on the progress of the Upper Limb Assessment Outcome Measures group**

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Background
The Upper Limb Assessment Outcome Measures group (ULPOM) was formed to promote standards in the assessment of outcome measures in upper limb prosthetics. It aimed to create a single terminology to assist in communications between individual clinicians and between centres. Initial work identified different existing measurement tools that either possessed sufficient psychometric properties to be useful in the field, or had the potential to be validated to a sufficient standard [1].

In recent years the group has continued the work by finishing the validation process and cross validating some of the tests. It is also encouraging professionals to develop new tools to fill in the gaps identified. To gain access to a sufficient number of subjects to be representative and to allow good statistical power it is necessary to collaborate across centres and countries. New tools developed include the Clothes peg relocation task and AMULA [2], updating the UNB test and modifying the AHA-PAD for prosthetic assessment. This paper will describe one such test in detail and outline some of the other work members of the group have been conducting.

Method
To validate four different tests by performing the tests on a representative group of patients across four centres and three countries. The tests were also repeated on subsequent days to undertake repeatability studies.

Tests chosen were:
Southampton Hand Assessment Procedure (SHAP), Box and Blocks, Jensen Hand function test and Orthotics Prosthetics User Survey (OPUS).

Analysis
Initial analysis: Repeatability, Floor/ceiling effects, Comparative analysis

Bland and Altman plots (plotting the difference between test and retest for SHAP and Box and Blocks against the overall score), Interclass correlation coefficients (ICC), plotting SHAP score against B&B score.

Results
Of a target population of fifty, thirty have been studied with twenty three retests
22 Trans radial, 8 Trans humeral
12 Body Powered and 18 Myoelectric hands
SHAP and Box and Blocks show reasonable repeatability with all of the SHAP scored within 2 standard deviations of the mean (and all but one of the Box and Blocks). they also showed a good association between them (Pearson's Correlation of 0.4), with little ceiling and floor effects.
Jensen showed greater floor effects in the Simulated Feeding, and the Large light and large heavy objects.

Conclusions
The different tools selected by the ULPOM group are show reasonable repeatability and the SHAP and Box and Blocks would appear to have Criterion Validity. This is an encouraging start to the program of developing new tests with sufficient psychometric properties.

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Title: **The use of amCube Footwork Pro pressure plate in the tuning of ground reaction orthosis: A Case study**

Presenter: Graham Dunn
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The use of computerised gait analysis equipment in the tuning of Ankle Foot Orthoses (AFO) is long established however it is not available for most clinicians in day-to-day application. This case study will demonstrate use of pressure analysis in regular clinical use.

The AMcube Footwork Pro pressure plate was used with an active area of 490 x 490 mm and sampling at 200Hz.

A 15 year old patient with a diagnosis of congenital neuropathy, heart disease and developmental delay is the subject of the case study. She has a GMFCS of III using a posterior Kay walker with ground reaction orthoses. The patient was becoming increasingly unstable, more reliant on her wheelchair and adopting an increase crouched gait pattern.

Using the Footwork Pro pressure plate a number of dynamic and static assessments were undertaken in a regular clinical setting at Birmingham Children's Hospital during three sessions of testing. During this process three ground reaction orthoses were fabricated and tested under similar conditions. For each manufactured ground reaction orthosis the patient was allowed to trial the orthoses at home to become accustomed to the fit and reduce the impact of discomfort from new orthoses. The tibial inclination was then altered using removable heel wedges in her own footwear. A baseline motion of the body centre of gravity surface area of 4.026cm^2 was used as these were the last ground reaction orthoses that the patient felt suited her needs even if she felt she needed more stability.

Using Static Stabilometry it was possible to quantify sway in anterior / posterior and sagittal planes and to compare various tibial inclinations in footwear combinations and orthosis ridgitiy to find the most stable combination.

This data was also used to ensure that the ground reaction orthosis had suitable rigidity to provide a suitable knee extension moment. This trial and error approach using quantifiable data made it possible to achieve the optimal outcome of stability to mobility that was important to the patient.

The most stable static set up identified in the process proved impractical during walking and was rejected by the patient. This set up had a body centre of gravity surface area of 1.95cm^2. Alteration of the tibial inclination and of the trimlines to decrease rigidity increased this to 3.32cm^2 at which point she felt stable enough statically and was happy with her mobility.

This case has demonstrated the impact that such computerised equipment can have on patient outcomes. It has also been used as an example for the treatment of further patients using a more streamlined and methodical protocol.

Title: **Can a partial off-loading Ankle Foot Orthosis improve function and reduce pain following ankle injury?**

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The US and UK Military have found the advantages of improved personnel protection and surgical techniques for complex limb salvage patients has exposed a new problem of elective amputation due to low function and high levels of pain. The drive to improve clinical outcomes for the military population has resulted in the production of bespoke orthotic solutions which aim to provide the high levels of function found with current prosthetic rehabilitation.

The Intrepid Dynamic Exoskeletal Orthosis (IDEO) and the British off-loading Brace (BOB) use a rigid ankle design to transfer the high forces, created when walking and running, to posteriorly positioned struts. This design eliminates painful ankle movement and provides energy return at toe-off.

Successful use of the BOB, with reduction in pain and increased functional ability, for patients with severe blast injuries raised the question of expanding the inclusion criteria to other more commonly seen lower limb injuries within a civilian setting. A patient with structural damage to the ankle due to a longstanding inversion injury, with a history of multiple surgeries and significant pain, was provided with a BOB. The patient had a visually improved gait pattern, with the ability to run, when using the orthosis and reported greatly improved function with reduced pain.

The results of this case study show a potential for wider use of the off-loading and energy return principles of the BOB within the civilian population. Further studies are needed to prove cost benefits for use within the NHS with reduced need for surgery.

Title: **Identification and management of tibialis posterior tendon dysfunction in primary care**

Presenter: Mr Nick Gallogly, Clinical Lead Orthotist, MSc BEng BSc MBAPO
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Tibialis posterior tendon dysfunction (TPTD) has been described as a sudden or progressive loss of strength of the tibialis posterior tendon. Current research suggests that patients arrive into secondary care having missed opportunities of diagnosis and earlier intervention. The effect of this is the need for expensive diagnostic imaging, multi-disciplinary conservative management and in some cases, complex surgical resolution. By the time patients present to a specialist foot and ankle clinic they have had the condition for several years and have consulted numerous doctors As a result of this, foot and ankle specialists believe that many cases are going undiagnosed.

The overall aim of this research is to identify the current knowledge of general practitioners in the identification and management of TPTD with the specific aims of identifying if there is a training need to improve diagnosis and what, if any, is the misconceptions that may lead to a misdiagnosis.

An action research methodology was undertaken to ascertain current knowledge. A questionnaire was developed. The questions were structured and predetermined in order to achieve a degree of reliability. The questionnaire was anonymous and was sent out to a total of 70 GP`s across Berkshire who regularly refer to the local hospital. A response rate of 73% was achieved (n = 44) highlighting a general lack of knowledge, but identified four main areas of weakness, classification awareness, guidance of management, assessment technique and knowledge of the conditions potential to progress.

A learning program was developed based on the results of the questionnaires. Over an 18 month period, the author carried out “Hands on” foot and ankle workshops, presentations and developed an information sheet including a local pathway for the management of TPDT once it has been identified. A second round of questionnaires was sent out 6 weeks after the information sheet had been circulated. 60 questionnaires were sent to local GP`s with a response rate of 68% (n = 42).

The results showed an overall improvement in the knowledge of the condition. The demographics of GP`s for both rounds of questionnaires were noted to be the similar in terms of musculoskeletal interest and experience. The frequency of diagnosis increased by 28.5% and this was also supported by the increase in referrals to the authors clinic, where the term TPTD was correctly used. 28.5% improvement was seen to be a good figure given that the respondents only had 6 weeks in which to identify the condition amongst their patient groups. This is said to be even better when it is considered that 1% of patients that attend a GP surgery attend with a foot problem.

The research was able to demonstrate a gap in the knowledge of TPTD and the improvements that can be achieved when targeted intervention is undertaken. This ultimately will improve the prognosis of many patients with this condition as well as reduce the need for costly imaging and surgical intervention. This research also supports the need for a similar intervention nationally.

References:

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Kohls-Gatzoulis J, Angel JC, Singh D, Haddad F, Livingstone J, Berry G.(2004) Tibialis posterior dysfunction: a common and treatable cause of adult acquired flatfoot. British Medical Journal 329, Pages 1328–1333

Title: **Gait Correction using Functional Electrical Stimulation**

Presenter: Lynn Vale, Clinical Specialist
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The traditional orthotic approach to the correction of foot drop is to use an AFO. An alternative approach is to use Functional Electrical Stimulation (FES). This involves triggering the dorsi flexors and evertors to activate at the appropriate time in the walking cycle. A number of commercial Functional Electrical Stimulation devices are available. This talk will briefly give an overview of the physiology of Functional Electrical Stimulation and present a more detailed introduction to the various devices and clinical decision making behind device prescription. There will be some discussion on the use of Functional Electrical Stimulation for more complex gait presentation, for example, control of knee hyperextension.

Title: **The effect of "tuning" in ankle foot orthoses on gait parameters of children with Cerebal Palsy**

Presenter: Nicola Eddison
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Other Authors: Aoife Healy, Robert Needham, Steve Osborne, and Nachiappan Chockalingam

The primary aim of our investigation is to determine the effects of tuning ankle foot orthoses (AFO) in combination with footwear (AFO-FC) compared to an un-tuned AFO-FC on the gait parameters of children with cerebral palsy. A further aim is to determine a more practical way to enable clinicians to effectively tune AFO-FCs in a clinical setting without the use of three dimensional (3D) Gait analysis. This study has employed a 18 camera motion capture system to collect kinematics data along with a set of force platforms and pressure platform based walkway to collect kinetic data. Whilst providing preliminary results from this work, this lecture will also provide some results on physiological parameters before and after tuning. The paper will explore and discuss the possibilities of further, structured clinical trials.

OETT Lecture 2015

Title: **Technical and Scientific Advances in Human Movement Analysis – the role of the technician and that of a clinician**

Presenter: Professor Nachiappan Chockalingam PhD, CEng, CSci, PFHEA
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Whilst providing a historical overview to recording human and animal movement, this lecture will highlight the advances in technology and scientific techniques available for assessing human performance with a focus on Gait Analysis and physical rehabilitation. Whilst highlighting the basic concepts which underpin the measurement of movements within the human musculoskeletal system, this lecture will touch on mathematical and numerical modelling relating to biomechanics and gait analysis. In addition to this, Nachi will draw on his experience within clinical biomechanics and outline some of his latest research involvement which investigates novel motion capture apparatus based on MS-Kinect depth sensing and recognition technologies.

The lecture will touch on the need for in-depth material science research in the area of prosthetics and orthotics and draw some attention to the influence of these material properties on human movement. More importantly, the lecture will showcase the limitations within the current technology and the role of a clinician in the effective use of various technologies. To conclude, there will be some discussion points on the usefulness and applications of technology in clinical diagnosis and intervention.

Title: **Using Smartphones to Enhance Clinical Decision-making: Can your phone make you smarter?**

Presenter: Ed Lemaire
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Healthcare providers that treat people with physical disabilities use multiple tests in the clinic to obtain general ratings of a person's movement capacity and abilities, resulting in overall scores. Today's smartphones have integrated sensors, processing power, and easy to use interfaces that, with the appropriate software/apps, could enhance these tests to provide additional and immediate information to improve a healthcare professional's understanding of how the person moves. This presentation will explore smartphone-based technologies, custom software/apps, and clinical procedures to enhance to quantity and quality of human movement information that can be provided immediately to the healthcare professional. Realtime-reporting enhances the ability to make informed decisions on progress and treatment at the point of patient contact.

POSTER ABSTRACTS

Title:	**Evaluation of Therapy Pre-Amputation Consultations at the Royal National Orthopaedic Hospital**
Presenter:	Claire Owen, Specialist Occupational Therapist in Amputee Rehabilitation
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The British Society of Rehabilitation Medicine's standards and guidelines for amputee and prosthetic rehabilitation state that, "a pre-amputation consultation with an appropriate member of the amputee rehabilitation team should be arranged where amputation is a treatment option". The purpose of this project was to assess how many patients who undergo an amputation at the Royal National Orthopaedic Hospital have received a pre-amputation consultation with an appropriate member of the rehabilitation team. In addition, to evaluate both the timing and content of these consultations with a view to improving our services and ensuring they are patient focused.

All patients who proceeded to amputation were surveyed post operatively and both quantitative and qualitative data were collected through a questionnaire.

16 questionnaires were returned by patients post amputation. Results showed that all consultations took place face to face, jointly by a specialist OT and a physiotherapist. Although the timing of the consultation in relation to the date of surgery was variable between patients, all but one found the timing appropriate for their personal circumstances.

The majority of patients felt they received sufficient information during the consultation but some highlighted that more information regarding support available at home, benefits and return to driving would have been useful.

Patients also gave qualitative feedback to say the consultation was informative and beneficial. They suggested that a follow-up telephone call would help solidify information and give the opportunity to ask any missed questions.

Title: **The use of Socket Comfort Scores as an outcome measure: A Multi-Centre Study**

Presenter: Peter Taylor, Prosthetist

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Objective
To assess on a larger scale, the validity of using a standardised objective scale in measuring prosthetic socket comfort, a historically subjective entity.

Method
On a Multi-Centre basis, manually administer to patients the standardised Socket Comfort Score questionnaire, Pre and Post-delivery of all new prostheses or sockets. Record data collected using clinical software package, retrieve and analyse trends and report findings.

Approaches taken
Standardised Socket Comfort Score scale displayed in all clinic rooms to ensure consistent approach to questioning. Socket comfort scoring, Pre and Post, an explicit requirement of the normal checkout procedure questionnaire within the clinical software.

Range of operation
1st January to 12th June 2015 for all new prostheses or sockets delivered across four UK DSC's. All amputation levels and reasons for amputation included for comparison.

Results/ findings
Lower limb patients score new prostheses or sockets similarly and scoring tends to vary positively, Pre to Post-delivery.

Upper Limb patient scoring varies less from Pre to Post delivery and this patient group tend to not score socket comfort as regularly.

Taking the two largest reasons for amputation (Dysvascular and Trauma,) there are broadly similar Socket Comfort Scores recorded, with similar differences between Pre and Post-delivery scoring.

Conclusion/ Recommendation
The use of socket scoring as an objective method to measure prosthetic comfort is a simple, but high-quality system to help reduce the normally subjective feedback from a planned clinical intervention and should be implemented more widely in the clinical environment.

Title: **A six month review of outcomes for people undergoing major lower limb amputations from a single centre in South East London. Do different pathways mean different outcomes?**

Presenter: J Georgiou, Physiotherapist, Guys and St Thomas' Hospital Amputee Rehabilitation Unit

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J Barnes & M Fuller, Physiotherapists, Guys and St Thomas' Hospital Acute Vascular Service.

In order to inform local therapy teams of the outcomes related to different rehabilitation pathways we reviewed the outcomes for patients following major lower limb amputation at 1, 3, 6 and 12 months. These pathways included acute to home, non specialist inpatient rehabilitation, specialist amputee inpatient rehabilitation (ARU) and out patient amputee rehabilitation, including the prosthetics centre.

A retrospective audit of patient's hospital records was undertaken. Discharges for a 6 month period were scrutinized. Demographics, amputation level, co morbidities and discharge destination was collated at the acute trust. Outcomes were collated at the ARU and at the prosthetics centre at 1, 3, 6 and 12 months following their prosthetic delivery. Non limb users did not have functional outcome measures completed.

The data from this piece of work shows themes regarding the type of patient that is referred to the ARU and those that are not. The Charlston Index scores follow these trends and patterns emerged regarding the outcome measures for patients up to 1 year post prosthetic delivery.

We hoped to investigate trends between those having inpatient rehabilitation compared to amputee outpatient rehabilitation, however the low numbers of the second group did not permit this. We have results showing a rapid increase in patients function/ prosthetic outpatient measures following the intensive inpatient rehabilitation pathway for limb users and improved functional outcome measures for non limb users whilst in inpatient rehabilitation. Results do indicate a drop off in function post inpatient rehabilitation discharge at 3-6months, and themes regarding this have been analysed.

We have no follow up data for patients that were non limb users post inpatient rehabilitation discharge or out of area patients. We need to question who takes responsibility for the non limb user patients. Do the community services refer back into the specialist services when required?

Outcomes between 6 months to 1 year show interesting results which we believe warrant further investigation.

Title: **A Scoring Tool to Predict Functional Outcome in Lower Limb Amputees (BLARt) – A Pilot Study**

Presenter: Helen Naylor, Prosthetic Clinical Lead, Leicester Specialist Mobility Centre
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Background
Lack of objective assessment often results in patient expectations being unrealistic following amputation. We have developed a pre-operative predictive assessment tool for lower limb amputee outcomes, the **B**latchford **L**eicester **A**llman **R**ussell **t**ool (BLARt).

Aim:
The aim of this study was to pilot the efficacy of a preoperative assessment tool which would calculate the likelihood of successful prosthetic mobility outcomes following lower limb amputation.

Method:
The study population consisted of patients referred following lower limb amputation to Leicester during 2010-2013 and Sheffield during the year 2012-2013. Scores were subsequently derived from this information and compared to patients' functional outcome at discharge from primary prosthetic rehabilitation.

Results:
A score of 12 or below was associated with a 95% success rate of rehabilitation, while a score of 24 or more was associated with a 3% success rate. Scores in the range 13-23 were associated with an intermediate chance of success (47%).

Discussion & Conclusion
The BLARt tool offers a consistent pre-operative assessment based on objective evaluation of underlying clinical parameters and their influence on the rehabilitation process following lower limb amputation.
It provides patients with more realistic probability of rehabilitation success and can assist in setting realistic objectives. It is essential that patients should still be given the choice of attempting prosthetic rehabilitation but by having a BLARt assessment completed it is hoped that they will have a more realistic assessment and expectation of their probability of success in becoming ambulant once again.

Title: **Stance phase timing difference in patients using hydraulic ankle units**

Presenter: Raymond Moore

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Since their release prosthetic feet with integrated hydraulic ankle units have proven a popular prescription choice among amputees. One theory is that these lead to a more symmetrical gait pattern and to assess this we decided to evaluate one of the parameters of gait, the duration of stance phase and the difference in dominant and non-dominant sides. A mixture of twenty four K2 and K3 activity level amputees had their gait assessed on the pressure plate to establish the difference in stance phase duration between their dominant and non-dominant foot. The patients' existing prescription was then upgraded to include feet with a hydraulic ankle unit and then reassessed on the pressure plate after a four week trial. The difference in stance phase durations were again measured and compared to the initial readings. The results showed a statistically significant reduction in asymmetry of stance phase duration when using prostheses that included a foot with a hydraulic ankle unit. This improvement was irrespective of the amputees' activity level.

Title: **Does using the Foot Scanner speed up the delivery of bespoke footwear at Northern General Hospital?**

Presenter: Clara Bailey, Senior Orthotist
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The aim of the study was to determine whether using a foot scanner at assessment resulted in bespoke footwear that fitted first time, required only one fitting appointment and reduced the delivery time.

After the installation of the scanner in October 2012, patients who needed bespoke footwear were scanned during their assessment appointment in addition to the British Standard measurements, appropriate casts and foam impressions being taken.

Retrospective information, including the number of appointments needed before supply and for alterations was collected, and was compared to results from a comparison group of patients who had footwear made without a scan,

The results showed that using the scanner had improved the fit first time of footwear at NGH and so it was recommended to use the scanner during all bespoke footwear assessment appointments when possible. Its use has been introduced to colleagues and varying methods of scanning is to be carried out to improve the results and patients experience during the scan.

Title: **A qualitative assessment of the effects of the Avalon hydraulic ankle for Multiflex foot users**

Presenter: Raymond Moore

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Prior to upgrading from their current prosthetic foot prescription (Endolite Multi-flex) eleven K2 activity level patients evaluated their prosthesis using the Seattle Patient Evaluation questionnaire. The Seattle PEQ is a clinically validated self-reporting questionnaire using a visual analogue scale of 0 to 100. The PEQ contains multiple questions that cover topics of ambulation, transferring, utility, well-being, prosthesis satisfaction and gait satisfaction. Their prescription was then upgraded to the Avalon foot and following a four week trial of this the patients then re-evaluated their prosthesis with the Seattle PEQ. The results showed the patients felt a marked increase in all six of the domains evaluated. The results also include a comparison with a similar previous study completed on a K3 patient group who trialled the Echelon foot.

Title: **The Effectiveness of Using Microprocessor controlled Knee Joints for Lower Limb Amputees**

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This poster was produced as part of an evidenced based practice course run at Sheffield Teaching Hospitals NHS trust.

Members of the Armed Forces who lose limbs are usually fitted with microprocessor controlled knee joints (MPKs). The civilian amputee population has different funding opportunities.

Aims of the project:
1) Identify, review and appraise the evidence of effectiveness when using MPKs.
2) Summarise the evidence base.
3) Support appropriate non-veteran cases for supplying MPK's through existing available prescribing and funding mechanisms, or any new routes that replace the 'exceptional funding applications'.

Method: Systematic searches: AMED, EMBASE, HMIC, MEDLINE, CINAHL, HEALTH BUSINESSS ELITE, BNI, PsycINFO and Cochrane. Google Scholar & Google search, NHS Choices search and product websites/catalogues/manuals/contacted product reps/peer discussion.

Findings: The decision to use an MPK, and which MPK to use, should be based on the individual clinical needs. Evidence can be found to support specific outcomes to present a case for using an MPK to suit the Patient's individual needs. MPKs can demonstrate improved effectiveness in areas of incidence of falls, fall management, stumble recovery, step-over-step descent, gait symmetry and ability to participate in increased activities using different mode settings. The area of patient satisfaction, improved confidence and wellbeing is likely to be higher when using MPKs though this is an area that has been poorly studied. Further discussions and conclusions were drawn from the results found.

EXHIBITION

Our annual meetings would be incomplete without the support of the commercial organisations and exhibitors. We acknowledge with thanks and appreciate greatly their contribution to the success of our meetings.

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