IN THIS ISSUE

In this issue we have a really useful guest editorial on *The Orthopaedic Management of Congenital Lower Limb Deficiencies* giving students and graduates alike an overview of the topic. We are very grateful to Mr Chrishan Mariathas and Mr James A Fernandes from the Sheffield Children’s Hospital, U.K. for their excellent contribution.

We also have some interesting articles from graduates and students about their work, experiences and international partnerships.

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Guest Editorial

The Orthopaedic Management of Congenital Lower Limb Deficiencies

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Congenital lower limb deficiencies (LLDs) are a wide spectrum of disorders. While they predominantly affect a single side, a number of those we treat also have an element of deformity of the contralateral limb, not to mention the upper limbs. A combination of a limb length discrepancy, bony deformity, joint instability and soft tissue contractures can have a profound effect upon the patient’s mobility, and while the pathological process is non-progressive, the proportionate discrepancy that ensues provides management concerns all the way up to skeletal maturity.

Our management goals are to restore a normal mechanical axis with stable joints providing a reasonable range of movement and with almost equal leg lengths. We feel that providing this with the least possible psychological trauma gives the child a chance to not only thrive physically, but also progress in their education and maintain family harmony.

Proximal focal femoral deficiency (PFFD) is a prime example of a condition which requires all of the fundamentals mentioned above to be implemented and thorough assessment and evaluation is mandatory. Clinical assessment helps to identify contractures, knee ligament deficiency and the clinical limb length discrepancy. Radiological investigation with radiographs, CT and MRI gives a detailed picture of the anatomy highlighting possible femoral pseudoarthrosis, quantifying acetabular dysplasia, retroversion and neck shaft alignment. While these investigations provide a very detailed picture, often we rely upon arthograms (joint x-rays) and real time screening to assess the mobility of the femoral head in the acetabulum. Finally, the patient’s deficiency always needs to be put into context and prediction of their final discrepancy at maturity helps us to predict the limb discrepancy the child will take into adulthood, and therefore guide our management.

In those patients with a less severe discrepancy (less than 30 percent difference), biological reconstruction is our treatment of choice, however the course for these patients is often long and arduous, and it should always be highlighted to the patient and their family that it will not result in a ‘normal’ limb. Reconstructive techniques begin at the hip joint where femoral and acetabular osteotomies are used to improve joint congruency and maximise neck shaft correction and de-rotation (See figures 1 and 2). This often has to be combined with soft tissue procedures and is usually planned for children at the age of 2. Associated pseudoarthrosis will often require resection with osteosynthesis, and in some cases fibular grafting or use of biologics like bone morphogenetic proteins.

The first lengthening procedure is generally done at age 5 when they settle down in their school and subsequent procedures are around non important school years so that most length is achieved by year 9 at school. Any further final surgery is done before 18 years of age. Our unit predominantly uses circular or monolateral hybrid fixators for lengthening, depending upon the need for correction of angular deformities. The greater the lengthening required, the greater the risk of complications such as hip subluxation or knee subluxation. The use of cross knee protection is key when lengthening proximal to a cruciate deficient knee (see figure 3). There is a move towards early reconstruction of knee ligaments physeal sparing. Rehabilitation and physiotherapy are mainstay during the programme to reduce complications. Pin site care is of utmost importance. The older children now can have intramedullary lengthening nails but they are cost prohibitive. They are the future as they have significant advantages over the fixator technique especially compliance with rehab and no complications of infection or pain from pin sites.

Despite the significant advances made in lengthening it is important to have early discussion with patients and parents regarding realistic expectations, especially if the predicted discrepancy is more than 23-25 centimeters. Often, the prolonged staged reconstruction discussed above can have a significant impact upon childhood activities and parents should be aware that ablative therapy by way of a salvage procedure is associated with significantly more complications than when it is undertaken as a primary procedure. Cultural trends can play a huge part in the social impact an amputation has on a child and their family and we find it very helpful to introduce families that may be considering an amputation to meet with others that have been through similar.
Amputation with prosthetic reconstruction for congenital LLDs rarely leads to loss of function, and can in fact enhance activity levels. While it is generally ill advised to delay amputation and prosthetic fitting until one feels the child has developed enough balance to use prosthetic components, it is often helpful to perform amputation or disarticulation in children with PFFD around walking age. Simple prosthetic component designs ensure swift acceptance by the child. Articulated prostheses can be used well by 4 years of age and become a necessity when the child is required to sit at a school desk. As the child grows and develops, so can their prosthesis to cope with increasing demands and requirements.

Disarticulation is preferable to amputation in children to avoid problems with terminal overgrowth and stump revision surgery. For those with severe PFFD or fibular hemimelia with less than a 3 ray foot a Syme or Boyd disarticulation is the procedure of choice. In a child with severe PFFD these involve removing the foot, shortening the limb, fusing the knee and fitting them with an above knee prostheses. The Van Nes rotationplasty is an alternative that converts the limb into a functional below knee amputation by shortening the limb, fusing the knee and rotating the foot such that the ankle joint mimics the movements of the knee (Fig. 4). This depends upon stable ankle ligaments along with good foot function and can still require rotationplasties as the child grows to deal with derotation. In addition, the cultural and social context must be taken into account for the patient as psychologically it can be demanding. For the above procedures, fusing the knee creates a single, stable lever and helps improve hip alignment. Ideally after a Syme’s procedure and knee arthrodesis the distal end of the resultant limb should be at least 7cm higher than the unaffected side to ensure a prosthetic knee can be level with the contralateral side. The femoral growth plate should be resected to prevent excessive residual length as often in PFFD the tibia is of normal length and it’s length alone is sufficient for the residual limb.

In the case of fibular hemimelia the end organ or the foot should direct the treatment plan. Any foot with 3 rays or more and functional should be considered for biological reconstruction. Some can have foot stabilisation procedures and distal osteotomies of the tibia with resection of the fibular anlage. Subsequent lengthenings will give length and alignment. Any child with a maximum predicted 2-3 lengthenings tends to get a reasonable functional result as per literature. The end goals have to be very clear and lengthenings more than 3 tend to have significant complications.

No matter the ultimate treatment decision many children will require initial non-surgical management for their LLD. Shoe raises often correct discrepancies of 5 centimeters or less. Larger discrepancies may require the use of extension orthoses whose suspension component holds the foot in equinus and a prosthetic foot is used distal to this. In some cases this can be used as definitive treatment with satisfactory mobility.

This group of congenital birth defects are best seen in tertiary centres and with multidisciplinary input. Various options should be discussed with parents so that an informed choice can be made. Meeting other children with similar problems and different choices of treatment enhances their decision making. When families are undecided about choice of treatment sending for further second opinion is beneficial. Patient and family preparation is vital and will go a long way to achieving success.

Reference:

Fig 3: Taylor spatial frame for femoral lengthening for congenital short femur with cross-knee protection

Fig 4: Child 2 years following Van Nes procedure (Courtesy Dr D Paley).
France-Morocco:
A French Student’s Work Experience in Morocco

By Carolane Jacquemard
Institut Supérieur Technologique in Valence

Every year, the second year Prosthetics Orthotics undergraduates at the Institut Supérieur Technologique in Valence, South-Eastern France do a self-financed internship in Morocco with teachers in order to assist poverty-stricken inhabitants.

I’m Carolane, and as a student participating in this rewarding experience, I’d like to tell you about it. After a year and a half of preparation and fundraising, my class and I were finally able to experience our internship in Morocco and more specifically Casablanca. Our trip took place from February 17th to March the 9th 2013. The Casablanca workshop isn’t really different compared to the one we have at the school so it wasn’t really hard to adapt. The difficulty was more in the lack of material, so we brought some with us. I was able to treat two patients during our stay and worked with a partner.

My first patient was an eighteen-year-old girl with agenesis, a pathology affecting her left lower limb, and the fact that she was living 400km from Casablanca showed that she really wanted to make the most of this opportunity.

It was a first for both of us, because Aicha had never been fitted before, and I had never treated a patient with agenesis.

The first day we worked with the help of our orthotist/prosthetist instructor to examine the patient. Contrary to France, there is no social security so people with low incomes can’t afford tests or treatments such as X-rays. In Aicha’s case we didn’t have any X-rays to work on, making the treatment much more complicated. Indeed, her pelvis and femur not having a physiological shape, we couldn’t be sure of what we thought we were feeling during the examination. If we wanted to describe her limb we could say that she had a functional residual hip joint, a femur, a knee joint, a residual tibia and a residual foot locked in fixed equinus. Her left limb being shorter than the right one (her toes were at the same level as her right knee) she was moving around walking on crutches or hopping.

As Aicha likes to take care of her appearance we decided to do a carbon hybrid orthoprostheses device with a prosthetic knee and a prosthetic foot, which we tried to make as aesthetic as possible. We made a negative mold, modified the plaster looking for solutions to remain faithful to her anatomy, and started the device by making a foam liner. We then worked on a carbon fiber socket, the process was difficult to achieve because of the special anatomy of our patient. And finally we assembled it.

When we asked her to try it she was nervous and excited. We made sure that the device was correctly fitted and that her walking was as smooth as we could make it. She left the center with her device to test it for two days, When she came back she told us it wasn’t easy to walk with it at first but that she trained herself during this period of time.

We completed the finishing touches and met the patient a third time to make a final fitting and do the delivery. I think that her smile and the one her mother had as she tried her device and put on her jeans without seeing any significant difference in her two legs was one of the brightest I have ever seen. She actually walked without crutches for the first time in her life. It was amazing to assist her in this way.

There is a quote that says: “a smile costs less than electricity but gives more light”. After seeing the smiles of the patients in Morocco I’m convinced that it’s the truth.
By Ibrahim Suliman

My name is Ibrahim Suliman. I am from Nyala, Sudan. I am married and a father of two children. Since I was young I have had the desire to help and serve people. With this in mind, I completed my secondary school and joined the National Authority of Prosthetic & Orthotic (NAPO) centre branch of Nyala, as an assistant technician in 2004. With my limited skills, I was already able to bring smiles to people with physical disabilities. I knew that I had to improve my knowledge in Prosthetics & Orthotics (theory and practical) to do better in this field. Therefore, I decided to study the Sudan Diploma in Prosthetic and Orthotics (SDPO). Unfortunately, the training was stopped in 2009. In year 2010, I received a message from ICRC mentioning that I was given the opportunity to study at Mobility India, the only school recognized by ISPO in India. Initially, I had difficulties with English, but with the support of my sponsor at the ICRC and the English teacher provided by Mobility India, I am now able to speak and communicate with teachers and friends in English effectively. Studying in Mobility India provides me an opportunity to study with students belonging to different cultures and countries, where we can share our experiences, knowledge and learn about each culture.

Currently, I am undergoing a 6-month clinical placement after having completed the second semester of my 1st year. The clinical placements strengthened my practical skills. Service provision by Mobility India follows a multidisciplinary approach. The Rehabilitation team in Mobility India is a combination of Prosthetist & Orthotist, Physiotherapist, Occupational therapist, CBR Manager & Coordinator and Doctors as a visiting faculty. Working with each of them gives us students a level of confidence that our approach will bring change in quality of life with people with disabilities.

Every day, we get many service users with different types of disabling conditions to deal with. Our learning is not limited within Mobility India premises, we go to community projects and partner organizations supported by Mobility India to do assessment, take measurement & cast. We fabricate the prosthesis and orthosis at the workshop and go back for fitting. After visiting the community projects and partner organizations, I understood that the actual learning takes place when you are in the field. Our thought about prescribing the prosthesis or orthosis device changed from book knowledge to practical issues faced by them especially for those who live in rural areas. We understand that one cannot prescribe devices based only on condition but also consider the socio-economic factors, religion, working hours and place.

I am surprised that Mobility India goes to such an extent to support students. I am glad that ICRC has chosen Mobility India for me as place of study. After completion of my studies, I will go back to my country to serve people with disability, enabling them to achieve mobility as much as possible. I would like to express my sincere gratitude to the ICRC for sponsoring, training and guiding me. I also would like to thank all the patients for whom I fabricated prosthesis as they have made an immense contribution to my learning.

Madagascar: Anselm’s Story

Anselm’s Story
By Christian Rafamatanantsoa (ISPO Cat II Professional), Madagascar.

This is the story of a 14 year old boy called Anselm. He was in a motorcycle accident with his dad, while they were going to the market in April 2012. His Dad was seriously injured and underwent a trans-femoral amputation.

Anselm was seriously injured with a mutilation of the entire left lower limb and abdomen and elbow dislocation. He underwent eight surgical procedures, including a colectomy, a left hemipelvectomy, skin grafts and bone graft. The driver who collided fled leaving them in the middle of the road. Unfortunately, as in several African countries, these road traffic accident cases are part of everyday life in Madagascar. Fortunately a mobile phone company supported care costs until their recovery, while their insurance gave a paltry sum for compensation. Anselm’s father was fitted with a trans-femoral prosthesis and Anselm was paired to the appliances centre of AM with a hemi-pelvectomy prosthesis specially designed for him by using specific components such as polypropylene and knee joint CRE adapted for the hip joint.

Anselm joined school in early September and continues to be monitored for the maintenance of the prosthesis which still requires attention. A smile returned to his face and I felt the hope that is reborn in him.

See here a video of Anselm walking again!
reminded that every student brings their own unique and amazing perspective, typically based on some incredible life story. For this edition of the Newsletter, I introduce two more students, with very different life experiences, but with a common goal of advancing the edge of P&O clinical practice and research. Xenofon is an undergraduate student in our BS/MSPO program with a lifetime’s worth of P&O training under his belt, having worked with his father (a practicing clinician in Xenofon’s hometown of Athens, Greece). Derek is in the professional phase of our MSPO program (Class of 2015), and came to us following a career in movie effects engineering, where he became interested in materials science, engineering, and technology. Xenofon aspires to follow his father into clinical practice. From my discussions with the other instructional programs (and among my own cohort of colleagues!), I know that my observation is not unique: P&O is the calling of some of the most interesting students in the world.

Derek Becker  
**BS/MSPO Class of 2015**  
From an early age, I learned to work with gelatin-based makeup to be used for special effects. By the age of 21 I worked on my first major motion picture (Donnie Brasco with Johnny Depp and Al Pacino). That job lead to an apprenticeship at the Metropolitan Opera where I received my union card. After three years I left there to work on Saturday Night Live and numerous other films working with Richard De Niro, Richard Gere, and Mickey Rourke to name a few. After 8 years on the road traveling the world, I decided to change lines of work for something more stable. I wanted to continue to research materials for interfacing with the human body. This is where I meet Gary Zeller. He was an engineer who developed numerous chemical compounds and devices for use in movies, television, and for government use. He also changed my life. I decided to continue my education in this direction, beginning with obtaining my associates degree in materials science; I am now nearly finished with my studies towards the Masters of Science in Prosthetics & Orthotics (MSPO), and my primary interest is in upper limb prosthetics. I have a few ideas that I plan on researching but doing it with the “out of the box” thinking I have developed over the years. An example is the use of magnetic force seen in rail guns applied to prosthetic devices for power. I see many people just reading a book or the description of a device and taking it for what it is. No one is turning the book upside down, looking at it in the mirror to get a different perspective. This view needs to be applied not to achieve new materials but to use existing materials in new ways.

Xenofon Chronopoulos  
**MSPO Class of 2015**  
I was always fascinated by the works and complexity of the great electro-chemical machine that is the human body. From a very young age I used to visit my father in his Prosthetics and Orthotics clinic in Athens, Greece and observe his work with amputees and admire how the human body can adapt and heal from great injuries and how the human mind and spirit can thrive even in the direst of situations, fueled by hope and sheer determination. This fuel can, of course, be found inside every human. Sometimes, however, it needs a spark to ignite and drive the person forward. This is what I was always hoping to achieve in my life; to become that spark, to help in the rehabilitation of amputees and patients, not only in the physical aspect but physiologically and sociologically as well. I am particularly fascinated with the multidisciplinary nature of my studies. It is a great joy to learn how Biology can be combined with Engineering and Anatomy with Electronics, and help the physically impaired. I also enjoy Psychology, Sociology and Philosophy as they help me expand my mind, become more knowledgeable and mature and see the world from a different perspective and be open to new ideas and cultures. Prosthetics and Orthotics is currently undergoing a huge growth phase, a “golden age” if you like, due to the diabetes epidemic and the changing life styles globally. With millions of amputees worldwide and with about 350 million people with diabetes and 1 amputation every 20 seconds happening worldwide due to diabetes (source: World Health Organization) this is THE time to be in the forefront of innovation and new developments, to be one of the people that can and will make a difference.
Organised by students and staff from the Faculty of Engineering, Strathclyde Engineering for Development applies appropriate technologies internationally and includes specific projects such as the well-established solar power project in rural Gambia as well as the MUKTI Project. The MUKTI Project is organised by a team from the National Centre for Prosthetics & Orthotics in the Department of Biomedical Engineering. They raise funds and visit the clinic annually to provide instruction and assist in clinical treatment.

MUKTI means Freedom and the charities slogan is ‘Freedom from crutches’. The charity is supported by its benefactor Mrs. Meena Dadha along with assorted fundraising and charitable donations. The charity provides prostheses and orthoses for people with mobility problems as a result of amputation and polio, for example, who would otherwise be left without care and unable to provide for their families.

The Mukti team consists of 5 members of staff (Tony McGarry, Kevin Murray, Arjan Buis, Christine McMonagle and Sarah Day) who are currently preparing for a visit in February 2014. Each visit involves 2 members of staff and at least 4 final year students (depending on funds raised) who are able to immerse themselves in the local culture as well as contribute their clinical skills to assist in the provision of Prosthetic/Orthotic services to the local community in Chennai.

Further information about the MUKTI project can be found at: http://www.strath.ac.uk/biomedengineering/muktiproject/

University Principal’s wife, Lady Eileen McDonald says:

In my role as Ambassador to Strathclyde Engineering for Development, I am delighted to be able to support the excellent work carried out at the MUKTI Clinic. The work that is carried on at the clinic is nothing short of amazing. The charity provides prostheses and orthoses free of charge and, although priority is given to children and young people, no one is turned away. The positive impact that the clinic has on life and life opportunities of those that benefit from the provision of prosthetic limbs is quite uplifting. Through the University’s relationship with MUKTI, great opportunities are provided for our students to work in different cultures and with different technologies that can really make a difference.

Join our society!

www.ispoint.org

ISPO is a global multidisciplinary organization aiming to improve the quality of life for persons who may benefit from prosthetic, orthotic, mobility and assistive devices. The Society now gathers about 3,300 members in over 100 countries.

VISION: ISPO contributes to a world where all persons have equal opportunity for full participation in society.

As a Member of ISPO, you:

- Receive a free subscription to Prosthetics and Orthotics International, one of the leading international scientific publications in the field of prosthetics and orthotics (6 times each year)
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