A report article

Up-to-date current concepts, most relevant surgical techniques and procedures and extremely qualified Faculty members have been at the core of a three days international course on Limb Reconstruction, which took place in Verona from 14th to 16th May 2018 in the Orthofix Education Centre.

A group of 30 orthopaedic surgeons from Czech Republic, France, Germany, Italy, Switzerland and UK - together with some Orthofix representatives from Marketing, Clinical Research and Affairs departments took part in the three days practical training seminar on Limb Reconstruction. The Chairman was Franz Birkholtz, a very experienced orthopaedic surgeon from Unitas and Midstream Hospitals in Pretoria, South Africa; the other two members of the Faculty were Alexander Cherkashin, a world renowned and well recognized orthopaedic surgeon from the Texas Scottish Rite Hospital for Children (TSRHC) in Dallas, US and Amir Qureshi, an expert orthopaedic surgeon from the University Hospital Southampton NHS Foundation Trust in Southampton, England.

On the opening day Elisa Luciani, Orthofix Global Medical Education Manager, summarized the main objectives of the seminar: how to assess limb alignment and length discrepancies safely; how to manage the most challenging post-traumatic and congenital deformities, how to pre-plan surgery - from the X-rays phase to the assembly and the application of an external monolateral fixator; how to maximize the outcome of a hexapod based circular frame using the software in a proper way; finally, how to prevent and manage complications.

She also explained that the applied training methodology follows three main educational steps: "explain to me, show me, involve me" with an effective balance between frontal lessons and dry lab sessions. During the course, the experts presented a significant numbers of clinical cases, inviting the attendees to discuss and share their experiences.

Introduction to Deformity Correction

A skeletal limb deformity may be present at birth, or can be developed during growth or caused by infection (osteomyelitis), tumour or by a post-traumatic disease. Bone defects, deformities and limb length discrepancies can be treated in different ways using several types of orthopaedic devices, using internal fixation or external fixation. Amongst this last category, the most common external fixation frames are monolateral (Fig. 1), circular, (Fig. 2) and hexapod (Fig. 3).
For an orthopaedic surgeon it is critical to know how and when to best utilize at best the different available devices - analyzing the different features and following the correct indications - to manage the pathology and promote the quickest recovery for the patient’s future well-being.

A. Qureshi explained the principle of distraction osteogenesis to the participants and showed them how to apply a monolateral frame to perform a bone transport (Fig. 8) and to correct a distal femoral valgus deformity (Fig. 9); he was followed by A. Cherkashin who explained how to correct a tibial uniplanar deformity with a circular fixation frame (TrueLok) (Fig. 10).

When faced with a bone deformity, the surgeon must:

- proceed with an accurate analysis of the deformity;
- verify if it is worth correcting it;
- recognize the affected bone segment;
- find the apex(es) of the deformity;
- decide where the osteotomy(s) should be;
- plan external fixation assembly;
- define the correction strategy.

The surgeon should always view the aim of the treatment also from the patient’s perspective. Treatment time should be as minimal as possible and weight bearing should start as early as possible in order to speed up healing and improve functional outcomes.

**Deformity Correction with Hexapod Frames**

A. Cherkashin introduced the concept of a hexapod frame and explained how it functions in three-dimensional space, guaranteeing simultaneous correction of all of the deformity components, whilst providing simple frame construction and application. The new TL-HEX designed by the TSRHC can be considered the last evolution of this concept. With its robust aluminum rings, secured to the bone by wires and half pins and interconnected by unique telescopic struts, the computer assisted TL-HEX allows the surgeon to perform acute or gradual adjustments for simple or very complex deformity correction cases, as well as in trauma for fracture reduction cases.

**Blount’s disease**

F. Birkholzt introduced the session on Blount’s disease, from the name of Walter Putman Blount who brought the attention to this pathology in 1937, describing 13 children with *tibia vara* or *osteocondrosis deformans*. It is a developmental disorder characterized by the abnormal growth of the proximal part of the tibia resulting in progressive lower limb deformity, and it seems more frequent in the U.S. and Africa than in Europe. There seems to also be an association with juvenile obesity problems in some cases.

It seems to be a multifactorial disease, a combination of hereditary and developmental factors are at play. The presence of strong genetic and biomechanical components (more people of African descent, more obese patients, with the overload of the physis) which produce the disturbance in growth and abnormal ossification of the medial part of the proximal tibial epiphysis and metaphysis.
It is common to underestimate the complexity of this disease. The infantile form, occurring in children from 2 to 4 years of age, is generally bilateral, progressive and associated with internal tibial torsion; it appears as a pathologic development of the physiologic genu varum; a lateral thrust is often present, suggesting incompetence of the knee ligaments, which increases the potential for progression of the deformity. The child can also walk or run in an unusual way on the toes, or rotating the leg. The child will be observed walking, with attention to her/his knees during the stance phase, to determine if lateral thrust occurs.

Ankle Equinus

F. Birkholtz introduced the session on Foot & Ankle illustrating Ankle Equinus, which is, in simple terms, a limitation of the ankle dorsiflexion. Generally, it is not considered a medical condition as such, but as the consequence of a condition where the foot is unable to dorsiflex or bend upwards at the level of the ankle. As a result of this condition, many problems occur to the foot and the ankle. It can be defined as “insufficient ankle joint dorsiflexion for normal gait, resulting in lower extremity compensation, pathology or a combination of both”.

A normal dorsiflexion is around 10 degrees or more (amount of ankle motion with the knee joint extended). Between 5 and 10 degrees there is a minimal foot and leg compensation during gait, but above 10 degrees the gait compensation is definitely significant, and we generally assist to an increase of pressure on the forefoot, with the risk of developing a forefoot pathology.

In many cases equinus may be not a ‘secondary finding’ but the underlying aetiology of many subsequent pathologies. If there is a limited motion of the ankle joint, the movement must then occur at adjacent joints either proximal or distal to the ankle, with a displacement of the body’s center of gravity. These compensatory mechanisms restore pivotal motion over the restricted ankle, but can result in pathologic processes proximally.

A. Cherkashin presented classification of hexapod frame assemblies and the application’s techniques of a hexapod type fixator for the foot and ankle deformity correction. Any hexapod frame applied to correct foot and ankle deformities can perform correction at single level, two-levels or multiple levels. Each level of correction may have struts connecting the hexapod supports oriented in horizontal or vertical manner. Two most often used frames are Single Level Horizontal frame for midfoot deformity correction (6H) and double-level orthogonal frame (6Vx6H) for simultaneous correction of ankle and foot deformities. In case of midfoot deformity correction, using 6H frame any hindfoot equinus (if present) should be corrected acutely in surgery. He also added that with a double level orthogonal 6Vx6H or 6V+6H frame a surgeon could correct practically any complex foot deformity, as it is a very powerful assembly. For double-level deformity correction, it is necessary to run two independent software programs for each level of correction.

Workflow Management

A. Qureshi underlined with strength the importance of an efficient and well-organized workflow management for reaching more positive results and better clinical outcomes. He explained his practical experience going through some steps:

1. Build a good team: “The whole team is working as a team for the patient” – A. Qureshi said;
2. Communicate – often, openly and warmly – with your staff: nurses, colleagues;
3. Prepare the theatre with accuracy and build a system which reduces the variables to prevent the margin of error: “When you ask for a wire you get it” – he said;
4. Preoperative phase planning is mandatory: “The more accurate you plan, the better outcome you can expect”;
5. Pre-construct the frame, spend time on the reference ring;
6. Feel comfortable in the theatre: “The most stressful situation could happen, the calmer you want to be”;
7. Post-operative (discharge & follow up) planning is also essential;
8. Question yourself: “What can i do to make my team working and feeling better?”;
9. Care of your team: take time to listen to them and to share some leisure moments with them.

Follow up after one week for the pin site care and correction control, to check if everything is going on well. Program adjustment if needed. The orthopaedic surgeon (himself), the plastic surgeon, the nurse, the physiotherapist, do the review.

Some live impressions on the course

The Voice of the Faculty

Franz Birkholtz (Pretoria, South Africa): “A very good level of interaction between us and the attending surgeons. The time of the course is limited, considering the number of topics. To increase its efficacy a suggestion could be sending them the course material before the course. We could also increase the number of practical cases, with more problem solving. However, they have progressed a lot during the course, since the first day. On the last day they were more confident, with more energy and could do a great job, it means that the system works”.

Alex Cherkashin (Dallas, Texas, US): “The program of the training course is a fine work in progress, we came a long way to create comprehensive agenda and we continue to adjust it to improve the quality of training. We have also succeeded in building a good relationship between the faculty and the attendees. There has been a high level of participation and many questions, a tangible sign of strong interest. Even though the attending surgeons often are not all homogeneous regarding their level of experience, we can always adjust the program on the go to provide adequate training to each one of them. The balance between lectures and practical session works very well. Dry labs on saw bones are perfect exercises for this level of the course, while wet lab can be more useful for a L1 (fundamentals) course. I would suggest sending some educational material and the questionnaire to the participants before the course, and perform post-course questionnaire to better access the learning; plus send the report article to the delegates after the course”.

Amir Qureshi (Southampton, England, UK): “A very good training course, I think the educational objectives have been fulfilled. The participants have learned a lot in these three days. Right number of participants in relation to the numbers of experts, in the lab we could easily keep an eye and support them”.

Text: Patrizia Salvaterra