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PROCEEDINGS

9TH EAST EUROPEAN AND MEDITERRANEAN MEETING FOR CEREBRAL PALSY & DEVELOPMENT MEDICINE

22-25 06/2022 YEREVAN ԵՐԵՎԱՆ

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PROCEEDINGS

9th East European and Mediterranean Meeting for Cerebral Palsy & Development Medicine

ՆՅՈՒԹԵՐ

Մանկական ուղեղային կաթվածի և վարգացման բժշկության արևելաեվրոպական և միջերկրածովյան 9–րդ գիտաժողով

МАТЕРИАЛЫ

9-ая Восточно-европейская и средиземноморская конференция по детскому церебральному параличу и медицине развития

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22 JUNE 2022
Gait Analysis Pre-Course 1

A: Normal Gait and How Can We Study It

Davit Sekoyan
Wigmore Clinic, Yerevan, Armenia

Walking is one of the most important human abilities, so any walking problem can affect quality of life. Many pathologies as cerebral palsy (CP), myelomeningocele, stroke, peripheral nerve injury, limb traumas etc. are accompanied with gait disorders. As one gait cycle lasts 1 second and it is very difficult to see all the gait problems in real time. Therefore, the most modern way of gait investigation is gait analysis laboratory where used technologies like 3D optical motion capture system to document movements, force plates to measure forces and dynamic EMG to see the muscle activities during gait. The understanding of data provided by gait analysis laboratory is essential for implementation of modern approaches for treatment of impaired gait. Before deepen in to gait disorders it is crucial to understand how do we analyze the gait and which are the main processes during normal gait. Therefore, to describe normal gait it is important to know how joints move in norm, how muscles work and what forces are appear to provide the normal conditions.

Gait analysis laboratory is useful tool for better understanding of gait disorder, especially during CP when the problems are multilevel and interconnected. It is also provides objective data for comparison of different treatment options and follow-up of the patients through the time.

B: How Gait Disorders Develop in CP Patients

Reinald Brunner
University Children's Hospital Basel,
Basel, Switzerland

For the development of gait disorders in patients with cerebral palsy, several factors need to be considered. Motor control requires adequate sensory input in order to align the present situation to the task to be performed. This alignment depends on cognitive function (motor experience and learning, development, judgement of the task performed) and is influenced by psychological factors (fear, stress joy). All these factors are affected in cerebral palsy. We further need to understand the effect of muscle activity. The plantar flexion knee extension couple is controlled by the gastrosoleus muscle. It is responsible for full knee extension and is even more used in case of insecurity and weakness. If the position of the segments in space, however, is inadequate it loses its knee extension effect. This is the case at about 30 degrees of knee flexion, and with more flexion, it actually flexes the knee. The hamstrings are mainly hip extensors under load and knee flexors in an unloaded position. A co-contraction of vasti and hamstrings in a situation of knee flexion shifts the effect of the hamstrings to the hip, hence to hip extension. The rectus femoris is important for the acceleration of the leg as a biarticular pendulum in swing. Weakness results in inadequate knee extension and toe walking. Considering these facts, the development of sagittal gait disorders can be explained: Insecurity, weakness, and developmental retardation lead to toe walking. The consequence is either a midfoot break or an equinus deformity. In both cases, the lever arm foot gets insufficient. The result is knee flexion which overloads the knee extensors. In order to reduce this load, the trunk is bent forward which requires hip extensor control, the hamstrings included. The biarticular overly activated muscles get short (gastrosoleus, hamstrings) while the monarticular vasti-patellar ligament complex becomes stretched out. Spasticity is not required to explain this deformity but contributes as it reduces motor control. In the coronal plane, equinus, midfoot break, and foot malrotation lead to malrotation of the leg. From this understanding, possible treatment goals are deduced. In principle, we need to avoid any knee and foot deformity (equinus can be compensated by a high heel), and correct disturbing deformities.

C: How Reliable is the Clinical Exam when Deciding on Functional Correction

Michael Aiona
Shriners Hospital for Children,
Portland, Oregon, USA

This presentation will briefly describe the four main components of a clinical exam: Strength, Spasticity, Range of Motion and Skeletal Alignment. A review of the literature on the influence of these components on the outcomes of therapeutic intervention for gait abnormalities will be presented. Interpreting the literature findings and its use in the approach to management specific gait abnormalities.

D: What Can We Learn from Gait Analysis for Decision Making?

Reinald Brunner
University Children's Hospital Basel,
Basel, Switzerland

Decisions on treatment are commonly taken on data from the static clinical exam the patient's complaints under the view of our knowledge and experience. However, the static data are poorly correlated with function, and our knowledge is based from theoretical anatomical considerations. Gait analysis tells about the interaction with external forces (gravity, inertia, accelerations) which can grossly change the use and the effect of muscle activity. While we can imagine the situation in quiet standing where only gravity acts vertical, such becomes difficult in function. The biomechanical analysis of motion provides limits of the range of motion of the joints to keep an energy efficient posture and function: hip and knee need to be extendible to 0° of flexion, and the sole of the foot or shoe needs to be perpendicular to the tibial shaft for even grounds. Under load, muscles may produce distant effects (the plantar flexors extending the knee). The hamstrings are more knee flexors in an unloaded leg but more hip extensors when under load. The prerequisites for walking and the biomechanical muscle effects of major functional importance are presented in respect of clinical situations.

E: A Case Discussion of Patient with Spastic Hemiplegia

Michael Aiona
Shriners Hospital for Children,
Portland, Oregon, USA

The management of a spastic equinovarus foot in a patient with spastic hemiplegia will be presented, highlighting the potential advantage of motion analysis in decision making.

23 JUNE 2022
Opening remarks

01: History of EEMCPDM Meetings

Michael Sussman
Shriners Hospital for Children,
Portland, Oregon, USA

The EEMCPDM is a group of friends and colleagues who have organized a series of 9 conferences since 2002, on topics related to CP and other developmental disabilities throughout the Eastern European and Mediterranean regions (including one in Xiamen, China). There are no membership qualifications, dues, or officers.

The goal of the group is to provide education to interested health professionals in the area, presented by experienced practitioners from many disciplines, as well as provide a forum for new ideas to be presented and an atmosphere where new collegial relationships can be established.

HISTORY: The EMCPDM concept began during a lunch between Selim Yalcin, Nadire Berker, and Michael Sussman at an annual AACPDM conference in Washington, D.C.

The first meeting was organized by the tireless work of Selim and Nadire in Istanbul in 2002, which was a great success, and thus the organization was born:

a. This was carried forward by Antigone Papavasiliou, pediatric neurologist in Greece who organized the 2nd meeting on the island of Santorini.

b. The next meeting was in Warsaw, organized by Marek Jozwiak, at which time the organization became the EEMCPDM

c. Subsequent meetings were held in:

- ► Eilat, Israel organized by Uri Givon and Kareem Abu Sneineh
- ► Beirut, Lebanon organized by Ismat Ghanem and Ayman Assi
- ► St. Petersburg, Russia organized by Vladimir Kenis
- ► Poznan, Poland organized by Marek Jozwiak
- ► Xiamen, China organized by Lin Feng
- ► Tel Aviv, Israel organized by Uri Givon and Kareem Abu Sneineh.

As time has gone on, new members have been added to the group, as older members have "aged out", and it is hoped that this group will continue their activities.

02: Introduction to Cerebral Palsy

Michael Sussman
Shriners Hospital for Children,
Portland, Oregon, USA

1. Definition
2. Classification
- a. By type of tone abnormality
- b. By anatomic distribution
- c. By severity: GMFCS and other measures

3. Outcome measures: technical
- a. Physical examination
  - i. Range of motion (contracture)
  - ii. Tone
  - iii. Visual gait analysis
- b. 3-Dimensional gait analysis

4. Outcome measures functional, according to WHO-ICF
- a. FMS
- b. GMFM / GMPM
- c. PODCI, etc.

5. Interventions to minimize motor deficits
- a. Physically based therapies: P.T., O.T., R.T., S.T.
- b. Adaptive devices: Walkers, canes, crutches, wheelchairs, etc.
- c. Orthotics: primarily AFOs

6. Medical interventions
- a. Botulinum toxin
- b. Baclofen: oral & intrathecal

7. Neurosurgical intervention: Dorsal rhizotomy
8. Orthopedic surgery: Principles
- a. Musculotendinous lengthening
  - i. Reduces contracture
  - ii. Reduces spasticity

b. Bone surgery
- i. Correction of excessive femoral or tibial torsion
- ii. Correct and stabilize foot deformity

9. Orthopedic surgery: Identification of problems, and options for correction

a. Assessment may be by visual or 3-D gait analysis
b. Although we analyze each level systematically, it must be recognized that each level influences all other levels, so most interventions address multiple levels simultaneously
c. In the coronal plane assess for excessive hip adduction
d. In the sagittal plane the Rodda and Graham classification is useful for identification of stance phase gait problems which involve knee flexion
   i. In addition, recognize stiff knee in swing
e. Torsional abnormalities may be present in the femur and/or tibia
f. Assess the foot and ankle
   i. The foot provides a lever arm to help control the knee and hip.
   ii. Tendon lengthening or transfer may help to control varus deformity (hemiplegia)
   iii. Boney surgery is usually necessary to control the valgus foot (diplegia)
   iv. In spastic diplegia always avoid Achilles tendon lengthening, which will weaken the lever arm and is likely to lead to crouch gait!

03: Etiology of Cerebral Palsy and Risk Factors

Antigone Papavasiliou
Department of Neurosciences, Iaso Children's Hospital, Athens, Greece

CP is defined as a non-progressive permanent disorder of movement and posture attributed to disturbances in the developing fetal and infant brain. CP is a highly heterogeneous condition in etiology and in clinical presentation. The clinical phenotype of CP may result from specific etiologies such as congenital anomalies/maldevelopments or from acquired brain injury during the prenatal, perinatal or postnatal periods, such as, prenatal or birth ischemia/asphyxia, central nervous system trauma, hemorrhage, stroke, or infection. When the specific etiology of CP cannot be accurately diagnosed, the current assumption supported by scientific evidence is that CP is most of the time related to prenatal neuropathology resulting from the interplay of genetic factors and environmental triggers, together leading to various pathways of injury. Several decades ago epidemiologists started discussing variables associated with an increased risk for the appearance of CP, implying correlational and not necessarily causal relationships. Tedious analysis of research data collected through various disciplines has confirmed that some risk factors are indeed causal determinants of increased rates of some of the types of CP. Others are still considered possible risks since the causal relationship is still unproven. Furthermore, the interaction of genetic variants, known to be linked or possibly associated with adverse neurodevelopment, with various events or known hazards in the prenatal or the perinatal period acting as triggering factors, may result in serious neurological outcomes including CP. Some of these factors seem to operate in infants of all gestational ages and others are associated with either full term or premature infants. Overall, preterm birth, intrauterine growth retardation, perinatal infection, and multiple births are considered the commonest risk factors associated with CP.

04: Early Diagnosis and Early Intervention in Cerebral Palsy

Nana Tatishvili, Sophia Tatishvili, Teona Shatirishvili, Anano Kvernadze, Anna Bedoshvili
Iashvili Children's Central Hospital, Tbilisi, Georgia

CP is the most common neurodevelopmental disorder in children, causing limitation of movement and posture. The motor disorders of CP are often accompanied by disturbances of cognition, communication and behavior, also by epilepsy and secondary musculoskeletal problems. Diagnosing CP is a complicated process with only 25% of infants currently diagnosed under the age of 6 months. Currently, average age of CP diagnosis ranges from 12 to 24 months. Nowadays, early diagnosis of CP is possible for the children aged up to 6 months in order to ensure early intervention and provide better outcome and family support accordingly. There are 3 important assessment tools that are used for early and highly accurate diagnosis of CP:

1. Neurological examination with Hammersmith Scale (HINE)
2. General movement's (GM) assessment
3. Neuroimaging (MRI).

Due to the fact that plasticity of the brain is much higher in early ages, early detection and intervention effectively influences and improves the outcome of the CP, movement, as well as cognition and communication. Early diagnosis of CP provides families with more opportunities for support. Today, every child with CP has the ability to get an early diagnosis before the age of 6 months, which is crucial for them and their families.

23 JUNE 2022
Orthopedic Parallel Sessions 1 & 2

05: Hip Surveillance in Patients with Neuro-orthopedic Disorders

Uri Givon
Safra Hospital for Children, Sheba Medical Center, Tel-Hashomer, Israel

Neuromuscular hip dysplasia (NMHD) is a common manifestation of neuro-orthopedic disorders. CP and other disorders such as Angelman syndrome, Rett syndrome and many unspecified problems are all characterized by spasticity and delayed development, leading to hip joint instability. The incidence of NMHD increases with the GMFCS, and may be over 90% in GMFCS V. Untreated NMHD will lead to dislocation of the hip joint, debilitating pain and reduced quality of life (QOL). Treatment is aimed at prevention of NMHD, reconstruction of the joint when possible and salvage when reconstruction is impossible. Early diagnosis and intervention allow for reconstruction and better results, leading to improved QOL. Schemes for hip surveillance have been in use for over 30 years, but have become organized in in the last decade. Studies have shown that the utilization of a formal hip surveillance scheme leads to a lower number of difficult reconstructions and salvage procedure. Most hip surveillance methods are based on standardized radiographs and measurement techniques using several technologies. Clinical follow-up and hip range of motion evaluation are an adjuvant evaluation. The frequency of examinations varies according to the GMFCS level. The COVID pandemic has led to missed clinic appointments and avoidance of medical visits, causing in some patients a rapid progression of the NMHD. Caregivers and clinicians should try to reach out to the patients and get them to return to their regular follow-up. In conclusion: Choose the system that is right for you, translate the instructions to your language and implement it.

Hip Reconstruction and Salvage Treatment Options in Cerebral Palsy Patients

Freeman Miller
Gait Analysis Laboratory, du Pont Institute, Wilmington, Delaware, USA

Hip dysplasia, subluxation and dislocation are common in children and adolescents with CP. The incidence of hip pathology increases from almost 0% for GMFCS I to 78% for GMFCS V. Programs for early detection using X-ray surveillance and indications for early muscle balancing procedures are well defined. Some children still fail the early treatment or are not detected early and require hip reconstruction. The indications for hip reconstruction include migration percentage (MP) greater than 40% over age 8 but not severe degenerative arthritis of the hip joint. Joints that are too destroyed to reconstruct require salvage or palliative procedures. Spastic hip reconstruction procedure requires making sure the femoral head is reduced into the acetabulum which requires femoral shortening, varus osteotomy, and sometimes adductor muscle lengthening and capsulectomy. The femoral head needs to be stabilized in the acetabulum which requires an acetabular osteotomy usually using a peri-ileal turn down procedure, a variation of the Dega osteotomy. Postoperative management usually focuses on early passive range of motion to encourage joint remodeling. Cast immobilization is not required. For hips which are judged to have too much degenerative change, especially in patients following completion growth, reconstruction may not be possible requiring palliative management for pain control. Reducing hip motion, such as passive stretching, can sometimes reduce the pain enough that further management is not needed. Reports of using high dose botulinum injections have found at least temporary pain reduction. If these are not successful, our preferred treatment for patients with standing and ambulatory ability is a standard total hip replacement. This provides excellent pain relieve and with modern prosthesis has minimal

complication. Options for individuals who have severe spasticity or dystonia and are non-ambulatory; include interposition arthroplasty with shoulder components or bone cement, proximal femoral resection (Castle's procedure) or some combination of resection and proximal valgus osteotomy.

07: Dega Pelvic Osteotomy in Spastic Hip Disease

Marek Jozwiak
Department of Pediatric Orthopedic and Traumatology, W. Dega Orthopedic and Rehabilitation University Hospital, Poznan University of Medical Science, Poznan, Poland

Dega pelvic osteotomy, primary reserved for children with congenital hip dislocation, has had a huge impact on contemporary world pediatric orthopedics. Developing of transiliac osteotomy – Dega's hip osteotomy, was a great step forward in this field of congenital deformities treatment. The global implementation of this surgery technique gained particular dynamism in the 1990s after it was published by Ward and Grudziak. Since then, derivative surgical techniques called Dega, Dega-like or Dega family osteotomies have been developed. The pelvic osteotomy described by Dega provides better superolateral (superoposterior) coverage than the other procedures described before as an acetabulum reshaping osteotomies. The surgical principles of Dega osteotomy including practical aspects, intraoperative tricks, are presented during this lecture. Nowadays, the Dega osteotomy is implemented to the treatment of many pediatric orthopedic indications, from developmental hip dysplasia, Leg-Calve-Perthes disease, other congenital or femoral deficiency to spastic or flaccid hip displacement in neurological conditions. The further osteotomy development based on anatomical and biomechanical evidence is widely open for future.

08: Orthopedic Considerations for Standing Training in Neuromuscular Conditions

Marek Jozwiak
Department of Pediatric Orthopedic and Traumatology, W. Dega Orthopedic and Rehabilitation University Hospital, Poznan University of Medical Science, Poznan, Poland

Children with CP who are non-ambulant (stand or walk independently). The therapeutic program of supported standing started to be most popular form of conservative treatment. Static standing is time-consuming, and while it may benefit the well-being of many children, it may be contraindicated for others. Therefore, the aim of this presentation is to present bone and muscle related benefits of standing training for GMCS IV and V children, but also the risk factors and contraindications to that therapy.

The presentation contains the principles of:
- Regular anatomy and hip joint architecture
- Forces distribution analysis around spastic hip joint in supported standing position
- Hip joint geometry and space orientation in standing position.

On the basis of such theoretical background the main goals of standing training are presenting, including improvement of: bone mineral density, muscle strength, posture symmetry, body shape, and reduction of: limb contractures, risk of hip dislocation, muscle-skeletal pain. The above-mentioned topics are discussed in the spectrum of orthopedic indications and contraindications. From a family perspective, the standing training is one of the most promising and cost effective therapy applied for non-walking children. From both a healthcare and a societal perspective, standing is strongly recommended procedure both from the muscle – skeletal, and participation perspectives.

09: Upper Extremity Treatment Options

Freeman Miller
Gait Analysis Laboratory, du Pont Institute, Wilmington, Delaware, USA

The upper extremity impairment in children with CP has received less attention compared to the lower extremity. The natural history of the upper extremity impairment follows the neurologic development seen in the lower extremity. Motor control improves into middle childhood and fixed deformities tend to develop during late childhood

and adolescents. There are two general groups that have different concerns and expectations. Children with unilateral CP (hemiplegia) tend to have one normal functioning limb and often develop a pattern of learning how to do most activities with a single limb ignoring the plegic limb. Therapeutic efforts are often made to address this by immobilization of the functional limb to force use of the plegic limb. This enforced use therapy compared to encouraged bimanual therapy has not shown clear benefit over time; however, in the young child therapy is the primary treatment. As the child gets to late childhood and early adolescence, the limb often develops a pronated, flexed wrist and elbow posture that is cosmetically very apparent. At this age there is often desire of the child for cosmetic correction however the parent desires functional improvement since they see that the child does not use the limb. This s the best age to consider A SMLS approach to the upper limb most commonly an elbow flexor lengthening, pronator teres release or transfer, flexor carpi ulnaris transfer to wrist extensor, thumb adductor release. When this is done before severe contractures develop between ages 8-12 there is usually a good cosmetic correction which is maintained long term, but typically little functional improvement. For the more severe and neglected limb that has no functional use, a wrist carpectomy and fusion can provide an excellent cosmetic result. The second large group of children is those at GMFCS IV-V level in whom the primary concern is custodial care. These individuals are usually in the later teenage years and have shoulder adduction contractures, elbow and wrist flexion contractures that become so severe that it is not possible to clean and keep flexion creases dry. They some times develop skin break down and a foul odor that is offensive to caregivers. At the shoulder a complete release of the pectoralis muscle will usually allow enough shoulder abduction for care, likewise at the elbow, complete release of all the elbow flexors allows extension to 90° flexion which works well for care and at the wrist a complete carpectomy with as much further bone shortening as needed allows for internal fixation and fusion of the wrist, thereby allowing for care with some finger extension also possible. For individuals at GMFCS IV-V level who do have functional use of the hands, such as driving wheel chairs or self feeding, may occasionally request corrective surgery because of flexed wrist posture, pronation or adducted thumbs. These teenagers often are very limited in their upper extremity use, but have become very proficient with the limited function available. These individuals need to be considered very carefully because position changes may improve appearance but limit function and lead to disappointment. In these teenagers, if they desire correction, I recommend doing the least functional limb first so they see the result, before they risk functional loss in the best hand.

10: Decision Making in Surgery of Spastic Upper limb

Caroline Leclercq
Institut de la Main, Clinique Bizet, Paris, France

CP includes all the sequelae of infantile encephalopathies occurring during the perinatal period or during infancy. It manifests progressively during growth, but once established, follows a non-progressive course, which makes it in selected cases amenable to surgical treatment.

Clinical examination is the key to successful treatment. It is best performed with all the specialists involved in the patient's care. It is performed with a fourfold goal:

- Evaluate spasticity.
- Evaluate the motor and sensory deficit in the upper limb.
- Evaluate the existing function and functional needs of the upper limb.
- Perform a complete general examination in order to assess associated neurological disorders, and potential contraindications to surgery.

Botulinum is a valuable tool in assessing spasticity and differentiating it from contracture, in reinforcing antagonist muscles, and in mimicking the results of surgery. Symptoms may vary with the child's emotional state and fatigue level. Video recording of the examination is most helpful, both in the decision-making and in the evaluation of surgical outcome.

11: What is the Role of Surgery in Upper Limb Spasticity

Caroline Leclercq
Institut de la Main, Clinique Bizet, Paris, France

Functional surgery in the spastic upper limb aims at re-establishing the balance between spasticity and contracture of hypertonic muscles on one side, and paralysed or weak antagonist muscles on the other side: It involves:

► Reducing spasticity. This is performed via partial selective neurectomy of the spastic muscles, leading to a permanent decrease of spasticity without loss of strength.

► Freeing muscle / joint contracture. This is performed via muscle release, either proximal or a the musculo-tendinous junction, tendon lengthening, and occasionally arthrolysis.

► Augmenting paralysed muscles. This is performed whenever possible via tendon transfers.

In some instances with more severe deformities and limited or no functional potential, surgery aims only at improving nursing, reducing pain, correcting severe deformities, or improving cosmetics. In these cases, tenotomies, tenodesis or wrist arthrodesis may also be indicated.

12: Pediatric Hand Palsy: Brachial vs. Cerebral

Davit Abrahamyan,[1,2,3] Garen Koloyan,[1] Karen Petrosyan,[3] Aram Gazarian[4]
[1]Wigmore Clinic, Yerevan, Armenia; [2]Arabkir Medical Center, Yerevan, Armenia; [3]Department of Plastic and Reconstructive Surgery, National Institute of Health, Yerevan, Armenia; [4]Edouard Herriot Civil-Military Hospital, Lyon, France

The two most common pathologies presenting with the upper limb palsy in children are CP and neonatal/obstetric brachial plexus palsy (NBP), with a prevalence of approximately 1:400 and 1:500, respectively. Despite the etiopathogenetic differences, these diseases manifest similar consequences due to the early progression of negligence, stiffness and deformity of the upper extremity. Regular detailed neuro-orthopedic examination, an assessment of daily-life needs, and knowledge of the social and family environment are crucial for management. The rehabilitation (kinesiotherapy) is an urgency. It should start almost at birth and performed intensively and incessantly. Splinting and physiotherapy can complement kinesiotherapy. Surgery may be required for functional amelioration with or without a hygienic or aesthetic component, depending on the situation and age. CP is a central (cerebral), early, most often antenatal/intrauterine condition with 2 characteristics: pronounced central neglect (and therefore difficulties in coordination and development of movements) and spasticity of predominantly certain muscle groups, although there are also dyskinetic, ataxic or hypotonic forms. The typical upper limb appearance is mainly shoulder in internal rotation and adduction, elbow in flexion, forearm in pronation, wrist in flexion and ulnar deviation, thumb in palm and fingers in flexion or swan-neck deformity. Treatment should focus on spastic muscles, antagonistic paretic muscles and joint contractures. As mentioned above, three objectives should be considered: functional, hygienic or cosmetic. Early occupational therapy and physical therapy are essential elements in the care of CP children to keep the joints soft and to prevent the deformities. The treatment of spasticity is primarily based on targeted injections of botulinum toxin A, under ultrasound or electrostimulation control. These injections can be started from the 18th month and must be repeated every 6 months. Almost immediate kinesiotherapy and splinting should follow these injections. Phenol injections can be use for the musculocutaneous nerve and the motor branch of the ulnar nerve. Intrathecal baclofen may be proposed to in case of severe global spasticity. Surgical procedures with a predominantly hygienic purpose include wrist arthrodesis, flexor tenotomies and the ulnar nerve motor branch transection. Functional surgery may target the forearm prono-supination (e.g. Zancolli aponeurectomy and pronator quadratus tenotomy, pronator teres rerouting or forearm bones osteotomy), the wrist and finger flexion (e.g. bayonet lengthening or Zancolli aponeurectomy), the wrist extension (e.g. flexor carpi ulnaris to extensor carpi radialis brevis transfer) or the thumb (flexor pollicis longus lengthening, extensor pollicis longus shortening, abductor pollicis disinsertion, and joint stabilization etc). The maximum of procedures should be implemented at the same time, followed by 4-5-week immobilization and the resumption of active rehabilitation. NBP is a peripheral (brachial), mainly intrapartum (obstetric) dis-

order that, if not managed early and consistently, will result in neglect of the affected limb, aggravated during adolescence when the unsightly side will lead to hiding this paralyzed limb, not to mention its utilization. The typical upper limb appearance depends on the level of the brachial plexus lesion. The upper (C5-C6 ± C7 or Duchenne-Erb's palsy) brachial palsy (most common ≈65%) affects the shoulder and the elbow: the baby moves the wrist and fingers, but cannot supinate the forearm, flex the elbow (in case of C7 lesion – also cannot extend the elbow), as well as flex, abduct and externally rotate the shoulder. The newborn presents with the shoulder in internal rotation and adduction, elbow in extension, forearm in pronation, and wrist in flexion and ulnar deviation (in case of associated C7 injury): in medical jargon this is known as "waiter's tip deformity". In severe cases, the C5 root damage can be associated with the phrenic nerve injury leading to respiratory difficulties. The lower (C8-T1 or Dejerine-Klumpke's palsy) brachial palsy affects the hand: the child moves the shoulder, elbow and forearm, but the wrist and fingers are immobile. The total (C5-T1) brachial paralysis manifests as a "flail hand" with the affected upper limb lying next to the newborn and not moving at all. Sometimes, in case of lower or total brachial palsies, sympathetic fibers innervating the ipsilateral eye can be damaged leading to Claude Bernard-Horner's syndrome: ptosis, miosis, enophthalmos, anhydrosis, and loss of ciliospinal reflex. Thus, concomitant phrenic nerve palsy and Claude Bernard-Horner's syndrome indicate the probable avulsion of (at least) the C5 and T1 roots, respectively, and are, therefore, predictors of poor recovery. As with CP, the initial management of infants with NBP involves active rehabilitation beginning a few days after birth, when the pain has subsided. The objective is to maintain joint mobility before possible spontaneous recovery, which occurs in majority of cases (≈75%). The treatment remains conservative in the event of early recovery of the biceps brachii function (active elbow flexion before 3 months). The primary (neural) surgical management is considered in the event of a sign of the radicular avulsion (see above) or in the absence of spontaneous recovery (active elbow flexion <50% by 6 months). Spontaneous recovery of the biceps between 3 and 6 months, if kinesiotherapy has been well conducted, gives better functional recovery than surgical treatment. The surgical repair can be done either by graft reconstruction of the affected roots, trunks, divisions or cords using the sural nerve autografts mainly targeting the hand function, or by neurotization using different "donor" nerves for targeted repair of individual branches of the affected plexus (e.g. Oberlin's procedure – ulnar-to-biceps and median-to-brachial – for elbow flexion, accessory-to-suprascapularis for shoulder external rotation, radial-to-axillary for shoulder flexion-abduction, etc.). Secondary surgical treatment, in the absence of complete recovery, involves: injections of botulinum toxin from 18 months (e.g. shoulder internal rotatory contracture, biceps-triceps co-contracture, etc.) followed by splinting and intensive kinesiotherapy, muscular disinsertions (e.g. subscapularis release), muscle and tendon transfers (e.g. l'Episcopo's procedure – latissimus dorsi for resuscitation of shoulder external rotation, triceps or latissimus dorsi or neurotized free gracilis muscle for elbow flexion, etc.), derotation osteotomies (humerus for a shoulder fixed in internal rotation, antebrachial bones for fixed pronation), arthrodesis (scapulohumeral, wrist). The surgical choice depends on a rigorous clinical examination with motor and sensory examination, and assessment of needs. Thus, the pediatric hand palsies occurring in CP and NBP, although different in their causes and consequences, however, have common characteristics. Their diagnosis and evaluation require a different approach, but the approach to their management, both conservative and surgical, is almost identical.

23 JUNE 2022
Rehabilitation Parallel Sessions 1 & 2

13: Follow-up Care of High Risk Infants

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A High Risk Infant Follow-Up (HRIF) Program oversees infants that were discharged from the Neonatal Intensive Care Unit (NICU). NICU graduates are often at higher risk for behavioral, developmental, and medical challenges later. Those born before 32 weeks of gestation, or with birth weight less than 1500 grams, as well as those with neurological or cardiovascular complications after birth, are most at risk. Most HRIF programs are based in an outpatient clinical setting and have a minimum of three visits per child. The first visit usually occurs around 4-8 months adjusted age. The second visit usually occurs around 12-16 months adjusted age, and the third visit usually occurs around 18-36 months of age, preferably 24-36 months old (not adjusted). Additional visits can be scheduled as deemed appropriate by the clinical team. During each visit assessments are done by a variety of medical professionals and recommendations are made collectively. Individuals that make up the clinic usually include, but are not limited to: A physician, occupational therapist, physical therapist, psychologist, social worker, and nutritionist. The physician can be a neonatologist, a pediatrician with special training, a pediatric neurologist, or a developmental-behavioral pediatrician. The therapist on the team should be trained in developmental assessment, typically using the Bayley Scales of Infant Development (BSID), currently in its 4th Edition. The clinic can be multi-disciplinary or interdisciplinary as they follow each child over the first 3 years of life. As the child grows and develops the team will identify and treat any pre-existing and/or new issues as they arise. The visit entails a comprehensive history, physical examination, a neurologic assessment, a developmental assessment, family psychosocial and needs assessment. Other services that can be included are: a hearing assessment, a home assessment, an ophthalmologic assessment. Regardless, in the end families are connected with other agencies for other needed services and referrals are placed to appropriate specialists, as needed. In addition to early identification and recognition of issues, the team provides resources as needed and ensures that families connect to all the resources that are recommended in addition to their routine child care. One of the biggest concerns that can arise in High Risk Infants is CP, given their prematurity putting them at higher risk for neurological complications at and/or shortly after birth. The psychologist on the team would preferably have training and knowledge in recognizing and addressing infant and maternal mental health issues. The nutritionist would help with ensuring appropriate growth and nutrition for each child, and having some lactation training can also be beneficial. All in all an establishment of a HRIF clinical team allows professionals to work together to recognize and address special needs, refer families to resources as needed, and provide monitoring over the first, three, critical years of a child's life. Earlier identification of special needs leads to improved quality of life if intervention is provided early.

14: Rett Syndrome

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Rett syndrome is a rare genetic neurodevelopmental disorder that occurs almost exclusively in females and results in severe cognitive and physical disabilities. It is characterized by normal early growth and development followed by the loss of the previously acquired skills (developmental regression): the ability to crawl, walk, communicate, or purposeful hand movements. Additional abnormalities occur including ataxia and the development of distinctive, uncontrolled hand movements such as hand clapping or rubbing. Some children also have acquired microcephaly. Affected children often develop autistic-like behaviors, breathing irregularities, feeding and swallowing difficulties, growth

retardation, and seizures.

Most cases of Rett syndrome are caused by a genetic mutation in the MECP2 gene, on the X chromosome. It almost always occurs as a new mutation, with less than one percent of cases being inherited from a person's parents. It occurs almost exclusively in females; males who have a similar mutation typically die shortly after birth. Diagnosis is based on the symptoms and can be confirmed with genetic testing. There is no known cure for Rett syndrome. Treatment is directed at improving symptoms.

15: Management of Orthopedic Problems in Children with Rett Syndrome

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Rett Syndrome (RTT) is an X-linked progressive neurodevelopmental disorder with mutations in the MECP2 gene on the X chromosome, associated with arrest of development, stereotypic hand movements, cognitive disability, convulsions and loss of function. Neuromuscular involvement in patients with RTT may lead to loss of independent walking ability, spasticity and muscular imbalance. Most patients function at the GMFCS III-V levels, and many of those who maintain gait, need support and external motivation for mobility. Patients may present with scoliosis, neuromuscular hip dysplasia (NMHD), muscle contractures, and lower limb deformity. The orthopedic care of the patient is similar to that of patients with CP, with hip and spine surveillance. NMHD is progressive and requires intervention when the migration percentage exceeds 50-60%. Scoliosis may be treated conservatively with seating systems, and surgically when the curve exceeds 45°. Video motion analysis of RTT patients showed slow, ataxic gait with a wide base of support, pathologic initial contact, limited hip extension and ankle dorsiflexion in stance and limited knee flexion in swing. Ambulatory patients need orthotics, and may require muscle-tendon lengthenings and foot stabilization procedures when indicated.

We should keep in mind that patients with RTT may cease to walk following long immobilizations, and try to prevent it. RTT patients need a dedicated multidisciplinary care team, with good communication with the community school teams, in order to provide timely and good treatment to the patients.

16: Outcome of Pediatric Stroke

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Pediatric stroke has become increasingly more important over the last decade. Recent studies suggest an incidence of childhood stroke at 1.6 to 2.7 per 100,000 children per year. Despite its low incidence, stroke ranks among top 10 causes of death. In more than half of the surviving children with stroke, the risk of motor, behavioral, and cognitive disorders and epilepsy results in major long-term personal, family, and social consequences. It carries a risk of recurrence in 10 to 30% of cases. Mortality rate is approximately 15% and may be higher in recurrent stroke. Following childhood arterial ischemic stroke (AIS), acute hemiplegia is the most common presenting symptom and is present in 72 to 90% of cases, with estimates of the prevalence of chronic hemiplegia varying from 25 to 56%. The severity of the motor impairments varies; however, most children with unilateral stroke will gain or regain independent mobility and some have fine motor deficits. Research has suggested that lesion characteristics play an important role in motor outcomes following pediatric stroke, with poorer outcomes documented in children with more than 10% intracranial volume infarction. Studies have identified neuroimaging features that might have an influence on the outcome: large artery stroke, bilateral infarcts, and involvement of basal ganglia were associated with poor outcomes. A study of 43 children with AIS, showed 82% with combined involvement of the cerebral cortex, basal ganglia, and posterior limb of the internal capsule had hemiparesis at follow-up.

The worse neurological outcome was found in patients involving the cortex, subcortical white matter, and thalamus. Both basal ganglia and cortical-subcortical involvement were associated with a poor prognosis. In conclusion neurological outcome after pediatric ischemic stroke is variable, with moderate-to-severe deficits in 30% of patients. The sensorimotor area is most affected. There are controversies on prognostic factors of outcome; however, neuroimaging features may be important for prognosis.

17: Recognizing Autism, Autism Spectrum Disorders, and Neurodiveristy

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Autism and Autism Spectrum Disorders are an ever popular collection of symptoms typically diagnosed in early childhood and requires specific treatment modalities to ensure improved quality of life. The DSM-5 diagnostic criteria states that a child must have persistent deficits in each of 3 areas of social communication and interaction, plus at least 2 out of 4 types of restricted interests, repetitive behaviors, sensory integration challenges, and/or inflexible adherence to routines. Differential diagnosis for Autism can be broad including, but not limited to conditions such as, Global Developmental Delay, Anxiety, Fragile X syndrome, Intellectual Disability, or other genetic and/or developmental conditions. Usually the key difference in pinpointing an ASD diagnosis are the deficits in social communication and social reciprocity, especially since many of the secondary symptoms of repetitive behaviors, restricted interests, and sensory integration challenges can be seen in other diagnoses as well. When making an Autism diagnosis severity is determined based on impairments and restricted, repetitive patterns of behaviors, symptoms must be present in the early developmental period, symptoms should cause clinically significant impairment in social, occupational, and or other important areas of current functioning, and theses disturbances cannot be better explained by intellectual disability or a global developmental delay. Notations should also be made regarding any accompanying intellectual disability or GDD, language impairment, genetic condition, or association with another neurodevelopmental, mental, or behavioral disorder. Autism can be diagnosed by trained individuals including psychologists, pediatricians, developmental-behavioral pediatricians, neurologists, or psychiatrists. Autism Spectrum Disorder diagnosis is usually a clinical diagnosis, although there are multiple testing modalities developed ranging from the gold-standard ADOS-2, the ASRS, CARS-2, amongst others. Early identification and treatment for Autism tends to provide better outcomes. Treatment for ASD includes speech therapy, occupational therapy, feeding therapy, behavioral therapy, applied behavioral analysis, etc. More recently there has been a global movement to recognize Autism not as a disability, but more as a constellation of "neurodiverse" differences in individual brain function and behavioral traits. Neurodiversity is the idea that all people interact and experience the world in different ways and that there is no one "right" way of thinking, learning, and behaving, and differences amongst individuals should not be viewed as deficits or diagnoses.

18: Sensor Processing and Autism Spectrum Disorders (ASD)

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Sensory integration (SI) is the normal neurological process of organizing sensations for use in everyday life. We use sensations to survive, to learn, and to function smoothly. Typically, our brain receives sensory information from our bodies and surroundings, interprets these messages, and organizes our purposeful responses. Sensory Processing Disorder, also called Sensory Integration Dysfunction or Sensory Integration Disorder, is an inability to pull together and understand (or process) sensory input. Usually without conscious effort, we make adaptive responses and we are probably not even aware that our bodies are making these adjustments. In case of violations of sensory signals will appear dysfunction in motor, cognitive development, as well as in the child's behavior. Sensory integration process begins with the first weeks of fetal life and the most intensively proceeds to the end of preschool age. More than 70% of children who have any developmental delay of speech, motor and emotional sphere, problems with learning, behavior, and communication, based on a disruption of the process of organizing the work of sensory systems. No part of the central nervous system works by itself: information transferred from one part to the other. Touching helps to see, vision – to keep balance, balance – to feel the position of the body in space and to move, the movement – helps learning. The brain needs stimulation; it excites the brain and creates it functional activity. From birth, children develop only under the condition of constant stimulation by sensations from their own body and environment. A huge amount of information from the senses goes to our brain every

second, and the brain must organize it, choose the most important, necessary and reject unnecessary from the numerous incoming sensory signals. If the child was born healthy and his sensory stimulation is normal, then he has no problems with the development of motor skills, speech and behavior. Children who have not sufficient sensory stimulation at the beginning of life for some reason develop a variety of delays. The way a child processes the surrounding and internal information affects the development of his feelings, thoughts and actions. The slightest disturbances in the processes of brain activity may affect the way the child masters household skills, learns and communicates. With age, problems multiply and there are difficulties with development, schooling and behavior. Sensory stimulation and accumulated experience contribute to the growth and development of the child. The brain has a remarkable ability to adapt sensory information to the requirements of the environment and to human needs, and to inhibit sensory information that is unessential for a given purpose. When we get used to certain sensory sensations/information, the brain automatically ignores them, and if the information is not blocked at the moment, the brain can be overly stimulated, overloaded. Unfortunately, many children have not developed a protective, inhibitory ability of the nervous system. This can be expressed in absent-mindedness, hyperactivity or impulsiveness – the child as if no "brakes", he/she is unable to properly respond to certain sensory information. When too much information, the brain is overloaded and the child forced to avoid new sensations, when the information is too little, the brain searches for additional sensory stimuli. Extreme sensory issues are very common in autism. Autistic children with sensory issues have difficulty filtering sensory input. Their nervous systems do not know what to block out and what to amplify. All these children had a "mono-channel" nature of perception. They isolated from the wide variety of sensory signals certain affectively significant stimuli for them (for example, sounds, smells, etc.), and consequently, the surrounding world appeared to them as chaotic and fragmented. Children experienced discomfort, because the sensory signals of a certain modality proved to be too strong for them. In this case, children have sensory defensiveness syndrome - a steady desire to avoid such irritants. Sensory defensiveness met in tactile, auditory, visual, vestibular, olfactory and gustatory modalities (tactile in all children). It is obvious that children with sensory integration dysfunction could not cope with the above problems and occupational therapist used modern proven and well-established methods of teaching and assessing skills in order to develop a carefully structured individual program for each child.

19: Autism Spectrum Disorder: Early Intervention Strategies

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Individuals with autism have an evident struggle in social interaction, social communication and may display repetitive and restricted interests and behavior with onset during early childhood. The etiology of autism, however, remains unknown. These behaviors can be challenging for the parents. Early diagnosis and intervention have proven to be beneficial to reduce or control the challenging behaviors in children with autism. The first two years of life is a critical time to examine the early development and emerging symptoms of ASD with the hope that early intervention can prevent significant symptoms. The major goal of detecting ASD at the earliest age is to enable the child and family to access intervention services as soon as possible. The basis for this is that children's brains are constantly growing and have a great deal of plasticity while young making it more likely for the child to improve areas that are delayed due to autism. By implementing new behaviors through early intervention programs, children with autism will have significant improvement in developmental delays. Appropriate diagnosis and intervention are required as it plays an essential role in helping children with autism improve their communication skills; reduce meltdowns and bring for better parental compliance. The earlier a problem is identified, the earlier intervention can begin, and the more likely the little kids will have an opportunity to learn the skills they need to communicate, engage in social interactions and manage their behavior in "natural environment". Early intervention researches have demonstrated that kids learn best when they have the opportunity to learn and practice skills in the setting of everyday routines, activities and places. There are several approaches that we implement in our center in order to help children with autism spectrum disorder. Our early intervention program for children ages 1-5 diagnosed with autism spectrum

disorder are working to determine the most effective treatment approaches for improving speech, language, play and social skills. This program is based on a strong parent-professional partnership. Individualized services focus on learning readiness; language; play; family participation; daily routines relevant to eating, bathing; and other areas jointly identified by ICDC professionals and parents. We combine direct instruction with parent training sessions designed to authorize families to become the most informed advocates for their children. One type of intervention will not be effective for all children on the spectrum of autism. It is very important to individualize each of these interventions and treatments to answer each child's individual needs.

Our methods for early autism intervention programs include:

- Applied Behavior Analysis (ABA) Principles
- Verbal Behavior
- Discrete Trial Training
- Incidental Teaching
- Positive Behavior Support
- Errorless Teaching
- Fluency Building
- Picture Exchange Communication System (PECS)/PODD
- Ongoing Program Evaluation.

In summary the benefits of providing early intervention services are follows:

- Better generalization of skills learned in natural environments
- Children are more likely to learn appro priate and effective social skills
- Substantial improvements are made in all areas of development, including physical, cognitive, language and speech and self-care development
- Family stress is reduced
- Dependency and institutionalization are reduced
- The need for special education services at school age is reduced.

Achieving improvements in the conditions of child development requires the involvement of people around the child and the support of social, health and education providers, who make major changes in the management of this disorder in the child's daily life and in his or her social and family status.

20: Epilepsy in Cerebral Palsy

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Epilepsy represents a major problem in children with CP. Its incidence varies from 15 to 60% and mainly depends on the type of CP. The following factors (low Apgar score at the 5th minute, neonatal seizures, focal-onset epilepsy and focal slowing on EEG) predict the development of drug-resistant epilepsy. Frequent uncontrolled generalized seizures and ongoing epileptiform activity on EEG may have devastating influence on development and increase the risk of Sudden Unexpected Death in Epilepsy. Close monitoring of the child with EEG may be helpful in early prediction of drug-resistant epilepsy. Treatment of seizures should be guided by seizure types, EEG abnormalities, MRI changes and may include anti seizure medication, hormonal therapy, surgery etc.

21: Ketogenic Diet for Epilepsy

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Dietary interventions for various medical conditions continue to be recognized and recommended. We will briefly review some historical roots of ketogenic diets for treatment of epilepsy. Existing clinical evidence and mechanism of action data will be reviewed. With the goal of identifying best candidates for this dietary intervention for seizures, we will review clinical information regarding how and when ketogenic diets could benefit your patients with various forms of epilepsy. This review will not cover, however, the dietary processes of how Dieticians actually formulate various ketogenic diets based on nutritional criteria.

24 June 2022
General Session

22: A Win–Win Situation: Pediatric Orthopedics and Pediatric Rehabilitation

Beat Knecht
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Rehabilitation, medical care and treatment of a multiply handicapped child with disorders such as CP or spina bifida can be challenging and demanding. This lecture gives an insight into the work methods of the multi-professional pediatric rehabilitation team and the successful cooperation of pediatric orthopedics and pediatric rehabilitation at the University Children's Hospital Zurich. Effective rehabilitation is not the domain of any single provider or discipline. Moreover, coordinated cooperation among the various professionals working in medical rehabilitation is important. Children with various diagnoses such as crouch gait resulting from muscle imbalance or increasing hip subluxation in children with movement disorders are regularly followed in the specialized Rehab Outpatient Clinic of the Children's Hospital by rehab pediatricians and neuro-orthopedic surgeons. After an orthopedic-surgical procedure, the children are cared for and treated jointly by the rehabilitation team and the orthopedic surgeons in the inpatient setting at the Rehabilitation Centre of the Children's Hospital. The rehabilitation team, usually led by the rehabilitation physician, consists of rehabilitation professionals from various disciplines. All work together to achieve the rehabilitation goals set on the one hand by the orthopedic surgeon and on the other hand by the patient and his parents. In order to see how this collaboration benefits the child and his family as well as the treating orthopedic surgeon, we need to have a look at how rehabilitation professionals proceed in the rehabilitation process of multiply disabled children. The health care professionals involved in the multidisciplinary treatment must fulfil basic requirements for successful cooperation in the rehabilitation process, this goes beyond their basic professional training program. They must be able to assess the patient's health condition in accordance with ICF-CY, analyze assessed data, set short and long term goals, select appropriate therapy and create a treatment plan, provide effective treatment and reassess treatment outcome. These competencies are closely combined in the so-called Rehab-Cycle, a clinical decision-making process for planning effective treatment. The application of the rehab cycle enables an oriented approach in pediatric rehabilitation. This approach considers the specific training program prescribed by the treating orthopedic surgeon as well as the expectations and needs of the patient and his or her parents. The problem- and goal-oriented approach in a holistic health care setting not only leads to a win-win situation of orthopedic surgery and rehabilitation. Even more, it leads to a high level of patient and parent satisfaction and thus to a win-win-win situation.

23: Clinical Diagnosis and Different Subtypes of Cerebral Palsy, Including Appropriate Diagnostic Work–Up

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CP represents a common phenotype caused by a static, non-progressive cause of perinatal brain injury or genetic changes affecting the cerebral control of motor pathways. It is characterized by lifelong problems impacting movement, strength, coordination, muscle tone, reflexes, posture, and balance. With about 18 million people impacted worldwide, CP is very common and often difficult to prevent due multiple, in utero and less often peri-partum and postnatal risk factors. We will review the clinical diagnostic criteria of CP, discuss its various subtypes, and correlate expected imaging findings with these subtypes. The many comorbid conditions affecting individuals with CP will also be discussed.

24: MRI Findings in Cerebral Palsy

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Brain MRI has demonstrated diverse lesions underlying CP phenotypes in 80% of patients thus leading to the elucidation of the etiopathogenesis of CP in most of these cases. It has become the most important diagnostic step after history taking, neurological examination, classification of the subtype, and identification of associated conditions. Specific MRI patterns have been associated with CP subtype, gestational age, delivery mode and other variables. In the recently published European population-based data from the SCPE network, predominantly white and grey matter injuries (around 50% and 20% respectively) have been reported and are considered acquired. Maldevelopments were found in less than 10% of cases, whereas normal findings in a little higher percentage (11.2%). MRI patterns of children with unilateral spastic, bilateral spastic and dyskinetic CP were predominantly lesional. In addition, preterm children presented with mostly lesional patterns (85%), corresponding to the gestational age. Children with ataxic CP had more maldevelopments, miscellaneous and normal findings. As a result, understanding the etiopathogenesis of ataxic CP is not as obvious as in the case of spastic and dyskinetic CP. Normal neuroimaging was frequently present in ataxic and unclassifiable CP patients. In these patients genetic studies can be particularly helpful in the diagnosis of specific syndromes or de novo mutations. Although brain MRI is not included in the definition of CP or required for the description of the condition, it is recommended for all cases of CP and particularly those of unknown etiology. It should ideally be performed after the age of 2 years because of developing myelination. In the case of a normal MRI acquired before the 2nd year of age, it should be repeated, as mild periventricular or basal ganglia/thalamus lesions may be missed.

25: Managing Spasticity

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Spasticity is classically described as velocity-dependent increase in muscle tone. However, in children with CP it is usually a complicated combination of reduced motor control, movement disorder and postural deformity. Each of these can be clearly defined but are hard to separate when they are all present in the same subject. Spasticity or increased muscle tone is often identified by parents as the child's primary problem, when it is in fact providing a benefit, substituting for other impairments. As an example, a child with poor postural control and underlying movement disorder may be able to sit up, have some head control and is limited in some uncontrolled movements by the spasticity. However spasticity can have significant negative effects by causing discomfort, joint dislocations and propagating muscle contractures. The decision to treatment, therefore, should consider the whole child with specific goals beyond reducing spasticity. There are many options for reducing muscle tone; however, none are clearly better than others. Oral medications such as diazepam or baclofen are often initial drugs used but none have shown long term benefit. Diazepam is a low risk very effective drug for short term spasticity control, such as following surgery, but after some weeks the child becomes accommodated and the drug is less effective. The same happens to oral baclofen. Focal management with botulinum injections has been heavily promoted for isolated spasticity and is most effective with the first injection and for 4-6 months. Due to recent information showing long-term muscle scarring, its use is slowly being more restricted. Global managements include dorsal rhizotomy and intrathecal baclofen. Rhizotomy is primarily restricted to high functioning GMFCS II or III children in middle childhood age with the goal in improving gait function. Recent reports have found that with 10- to 15-year follow-ups that the rhizotomy has little effect on gait function compared to a similar cohort who did not have this procedure. For children GMFCS IV and V with severe mixed spasticity and dystonia, intrathecal baclofen delivered with an implanted pump is the most effective treatment. This treatment is expensive, has a moderate rate of complications and requires careful long-term close follow up.

24 June 2022
Orthopedic Parallel Sessions 1 & 2

26: Crouch Gait: Natural History and Treatment

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Understanding the natural history of the development of gait in the child with diplegic CP is important to be able to communicate expectations to parents and to understand the expected evolution of deformities. Our goal of treatment of the child is to maximize normal development. Children with CP tend to start walking with supportive devices between 18 and 30 months of age. The improvement in the motor function continues till 6-8 years of age for those with high function such as GMFCS I and II; but reaches an earlier plateau at age 3-5 for GMFCS IV and V. Predictability of individual outcome under age 2 is difficult but improves with improving age and clear definition of motor function is present by age 5-7 years in GMFCS I and II. Spasticity is often a major concern in the young child between ages 2-5. The natural history of spasticity has been well defined as increasing gradually from age 1 to 5, usually peaking between ages 3-5 and then slowly decreasing. For the ambulatory child, motor control and balance also tend to improved reaching a plateau in late childhood. Based on understanding of this evolving and growing neurologic system, the primary treatment for the ambulatory child with diplegia age one to 8 is physical therapy to stimulate the child's neurologic system to reach their potential. During this time a few children may develop fixed contractures of the plantar flexors or hamstrings that merit surgical correction and a few have very severe torsional deformities that limit their progress. The use of ankle foot orthosis (AFO) is useful to provide stability in stance in the young child. Specific common early impairments are planovalgus feet which maybe very severe at age 2-3 but these will all improve with improving motor function and never need surgical care in early childhood. A few children develop fixed equinus by age 5 and do merit correction to have the feet plantigrade. As children get to late childhood and early adolescence (Age 8-12) torsional deformities and knee flexion contractures are becoming stable and impairing function or getting worse. This is the ideal time for the first course of major corrections using the Single Event Multi-level Surgery (SMLS) approach in which torsional deformities and contractures should be addressed before the full adolescent growth. Most commonly this includes some combination of femoral and tibial torsion, knee flexion deformity, hamstring contracture, rectus spasticity and plantar flexor spasticity. Some child may have developed severe planovalgus in late childhood or varus that merits correction. During the adolescent growth and weight gain, some further deformities may develop especially collapse into planovalgus of the feet and a final surgical assessment and SMLS correction should be considered at skeletal maturity. Based on our recent review, diplegic gait following skeletal maturity remains stabile at least into the mid 30s.

27: Knee Joint Contractures in Functional Cerebral Palsy Patients

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Knee joint contractures are of major importance for the gait in patients with CP. Still, they need to be regarded in a more global context. Motor control requires sensory input and alignment of the input data with the motor aim. This process is influenced by cognitive and psychological factors. I show how the knee joint is normally controlled. This is important to understand failures and possibilities for compensations. I further show how we can estimate the importance of clinical parameters from statical assessment in respect of knee motion during gait. The development of knee flexion during gait is briefly demonstrated as well as function and effects of especially the biarticular muscles. The goals for treatment are deduced and the principles of surgical correction at the various levels are demonstrated.

28: Rotational Deformities in Cerebral Palsy Patients

Michael Aiona
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Torsional deformities are a component of gait deviations present in ambulatory patients with CP. An approach to assessment, management, and surgical technique options will be presented with case illustration.

29: Patella Tendon Shortening for Knee Flexion Contractures in Cerebral Palsy Patients

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Crouch gait and the knee flexion contracture is one of the most common conditions in patients with CP. In ambulatory patients it is characterized by increased knee flexion during the stance phase. There are different factors which contribute to this condition: tightness/shortening of hip flexors and hamstrings because of spasticity, weakness or shortening of plantar flexors, mostly of triceps muscle. Persistent crouch gait may severely affect the ambulation and cause the anterior knee pain due to increased patella-femoral compression. The treatment options could include conservative methods, especially in young children, and surgical. Physical therapy to strengthen extension mechanism for knee and special extension brace may help to decrease knee flexion contracture, but the majority of patients will need the surgical treatment. In young children and in cases of short knee flexors the hamstrings lengthening will help to correct the contracture, while in older children and adolescence the distal femoral osteotomy with patella tendon shortening is the choice of surgical intervention. In cases of flexible knee flexion contracture and positive extension lag test it is indicated only patella tendon shortening, while with the fixed flexion contracture it should be combined with distal femoral extension osteotomy (with some shortening in severe cases). Clinical examination, X-rays and 3D gait analysis are very helpful in determining the cause of the knee flexion contracture and in decision making. There are several techniques of patella tendon shortening. Each of them may have its indications depending on patient's age and surgeon preference. The technique of "wrapping" the patella tendon and its shortening is more indicated in young patients. The most commonly used technique is the duplication of patella tendon with dividing it in frontal plane, shortening of posterior portion of the tendon and overlapping the anterior part of the tendon. This technique is safe and is used mostly on older patients, but still with open physis. In skeletally mature patients it is possible to use the patella tendon advancement when the tendon with its attachment to the tibial tuberosity is transferred distally. In our series of 31 patients the patella tendon shortening was performed on 56 knees for flexion contracture. In 6 cases only patella tendon shortening was used, while in 25 cases it was combined with distal femoral extension/derotation osteotomy. In 2 cases we used "wrapping" technique, in other 2 cases patella tendon advancement and in remaining 27 cases – the tendon shortening with duplicating method.

30: Treatment of Knee Flexion Contractures in Children with Cerebral Palsy

Pavel Rakhman, Oleksandr Korolkov
Ukraine

31: Hamstring Lengthening vs. Hamstring Transfer: Long-Term Outcomes of Hamstring Surgery in Spastic Diplegia, and Comparison of Hamstring Lengthening with Hamstring Transfer

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Introduction: Hamstring lengthening surgery alone (HSL), or with transfer of the semitendinosus to proximal to the knee joint (HST), has been a standard intervention, along with other indicated surgery at the hip or ankle (SEMLS), as well as P.T. and orthotics, for treatment of flexed knee gait in children with spastic diplegic cerebral palsy. However, there are few studies which provide long term outcomes following skeletal maturity, and some surgeons question the efficacy of hamstring surgery.

Methods: We have reviewed the clinical outcomes by physical examination and 3-D kinematics in our motion analysis laboratory for children with spastic diplegia who were treated with HSL or HST, prior to surgery, at 1 year post-operatively, and unless they had repeat surgery for this problem, at a mean of 9 years post-operatively. The entire study group consisted of 49 patients.

► 10 patients who had recurrence of knee flexion in stance and underwent repeat surgery prior to the 7-year minimum follow-up were considered for the overall failure analysis, but not for comparison of HSL with HST.

► 40 patients had all 3 studies

► 20 patients had hamstring intramuscular tendon lengthening

► 19 had hamstring lengthening + semitendinosus and gracilis transfer to the distal femur or adductor magnus tendon

Results: Total group outcome (HSL & HST) 49 patients

► 5 HSL & 5 HST patients had recurrence of dynamic knee flexion, and underwent re-operation, and did not have final study.

► 3 HSL and 4 HST patients had recurrence of dynamic knee flexion to greater than baseline at final follow-up seen on 3-D gait analysis, and were considered failures.

This gave a success rate of 65% overall, with a success rate of 69% in GMFCS I & II, AND 60% in GMFCS III patients.

Comparison of HSL & HST:

► Knee flexion contracture: Improved at 1 year and there was no recurrence in either group.

► Straight leg raise and popliteal angle: Improved at 1 year, and recurred to close to baseline at final f/u in both groups.

► Anterior pelvic tilt: Increased to 6° at 1 year in both groups, and decreased to less than baseline at 9 years in HSL, and increased by 5° in HST.

► Maximum hip extension in early stance showed no change in either group

► Maximum knee extension in mid-stance decreased in both groups at 1 year, and remained corrected at 9 years in 16/19 HSL and 16/20 HST

Discussion and conclusion:

1. About 2/3 of spastic diplegia patients maintained correction of dynamic knee flexion deformity at 9 years following hamstring surgery as part of a SEMLS approach.
    a. The GMFCS I & II patients had better outcomes than GMFCS III
2. There appears to be no increased benefit of transfer of the semitendinosus to a simple lengthening of the hamstrings for flexed knee gait.
    a. Long term correction of dynamic knee flexion was similar.
    b. There was no loss of hip extension in either group.

Pelvic tilt increased slightly in the HST group and remained at baseline for the HSL group at 9 years postoperative.

32: Long-term Outcome of Bilateral Cerebral Palsy Patients Treated with Hamstrings Lengthening

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Purpose: Define the factors that impact outcome at maturity in flexed knee gait pattern in children with bilateral CP who had hamstring lengthening. The goal is to define early parameters which are predictive of knee posture at skeletal maturity.

Methods: This retrospective longitudinal observational study used instrumented gait analysis (GA) before age 8 and after age 15 in children with bilateral CP who were treated at a single clinic during their whole childhood and adolescence. Bilateral CP is defined by having abnormal muscle tone or motor control present in both lower limbs. The primary variables for categorizing the position of the knee were mean knee flexion in stance phase and knee flexion at foot contact. Secondary variables included stance phase maximum and minimum knee flexion, ankle dorsiflexion and pelvic tilt.

Results: This study included 97 children with 194 Lower Limbs (LL). There were 55% males and 45% females. Mean age at the first GA was 6.0 years old (SD 1.2) and age at the final IGA was 19.8 years old (SD: 4.9). The mean follow up time was 13.8 years (SD: 4.9). Average GMFM-D at follow up was 72% (SD 20%) Mean knee flexion in stance phase initially was 26.9° (SD: 14.3°) and at final follow-up was 27.1° (SD 11.3°). Knee flexion at foot contact initially was 37.4° (SD 14.6°) and significantly different ($p<0.00001$) at follow up at 29.7° (SD 10.1°). Average ankle dorsiflexion in stance initially was 0.2° (SD 11.0°) and at follow up was 9.2° (SD 5.4°) ($p<0.00001$). Maximum stance knee flexion initially was 48.2° (SD 11.6°) and not significantly different at follow-up of 43.8° (SD 9.4°). Minimum stance knee flexion initially was 15° (SD 14.8°) and not significantly different at follow-up at 18.0° (SD 11.9°). Average pelvic tilt was not significantly different from the initial 18.7° to the final at 18.4°. Fixed knee flexion contracture initially was 3.5° (SD 7.0°) and was not significantly different at 3.7° (SD 8.2°) at follow-up. GDI mean initially was 63.1 (SD: 13.8) and was significantly different at final follow-up at 76.1° (SD 13.3°) ($p<0.00001$). Single HS lengthening was completed in 76 limbs (39%) and multiple (2 or more) times in 90 limbs (47%) while 28 limbs (14%) had no HS lengthening. This cohort had 835 other procedures in addition to the hamstring lengthenings. The data was analyzed with the goal of determining factors which predict improvement from the initial evaluation to the final magnitude of flexed knee gait in this cohort. The analysis used multiple linear regression modeling. The factors from the initial evaluation which correlated with improvement in the final flexed knee posture were high initial evaluation knee flexion at foot contact on both ipsilateral and contralateral sides, contralateral maximum knee flexion, and contralateral hamstring lengthening. Male gender was the only factor predicting poorer outcome.

Conclusion: In this study cohort of children with bilateral CP followed at one clinic through childhood until skeletal maturity in which every child had at least one hamstring lengthening indicating a diagnosis of flexed gait posture, there was no change in mean knee flexion in stance. However, there was improvement in knee flexion at foot contact, ankle dorsiflexion and GDI with no change in pelvic tilt. Children with more severe flexed knee posture at the childhood evaluation had the most improvement at maturity. Male gender was predictive of less improvement compared to female gender. These finding suggests that milder cases likely had less aggressive treatment, on average childhood knee posture can be maintained into skeletal maturity, and we need to be especially vigilant in monitoring knee posture in boys.

33: Equinovalgus Deformities in Children with Cerebral Palsy

Vahe Yavryan

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Equinovalgus deformity is one of the most common deformities of the foot in CP, especially in patients with bilateral involvement. The equinovalgus and planovagus deformity is usually consequence of wrong loading on the lower limb and impaired biomechanics. This also can be caused by muscle imbalance. These deformations bring to lever arm dysfunction which triggers self-impairment process and worsens the loading on the feet. The treatment includes conservative and surgical methods, which follow each

other. First, it begins with orthosis, which protect the foot from extreme deformations, and correct modifications may be adequate to prevent or to compensate such deformity. We can see the effects during gait analysis like decreasing crouch gait. If conservative measures are no longer effective, surgical treatment may be considered. Or if there is a significant deformity and the patient has conflict with wearing orthotic devices, surgery is indicated. For correction of valgus deformity bone procedures are the most effective and the surgery is the only predictable alternative for full and lasting correction. Surgical options are subtalar extra-articular arthrodesis, calcaneocuboid joint fusion lengthening, talonavicular fusion, different tendon lengthenings and combinations of all the above. As the final solutions for rigid and vastly deformed feet the triple arthrodesis is the last choice of surgical correction.

34: Treatment of Equino–Varus Deformities in Cerebral Palsy Children

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One of the most common deformities in the patient with CP particularly in hemiplegic ones is equinus and varus deformities of the foot. The cause of deformities is muscle function disbalance, spasticity, abnormal sensation and proprioception. The deformities can develop separately and in combination. The treatment starts from conservative methods as rehabilitation, serial casting, Botulinum Toxin injections and different combinations of listed above. The next goal of the treatment is prevention of deformities, which is possible due to wearing orthosis. Only after the conservative treatment options are exhausted, the surgical treatment is indicated. The mechanism of equinus deformities is shortening of Achilles tendon. Many different methods are described and are in use for heel cord lengthening. Each of them has its advantages and disadvantages though the aim of them is the same – lengthening of the tendon. Some of the authors suggest shortening the Tibialis anterior tendon for resolving drop foot after Achilles tendon lengthening. For varus deformity, the most effective and widespread surgical correction method is split tibialis anterior tendon transfer to the cuboid bone. This procedure allows rebalancing the forces around ankle joint. It is common to see this deformation in combination with equinus deformity, and the solution is combination of operations described above. The surgical solution of these problems is effective and improves the patient gait a lot. However, it is important to avoid overcorrection, as this can bring the patient into instability and irrevocable deterioration and crouch gait.

35: Braces for Foot Deformities

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The various principle types of braces are presented and the indication discussed. Positional braces, although most commonly used, have no proven effect. Corrective braces may be indicated to improve the range of motion of a joint or muscle length. Both are uncritical considering biomechanics of construction. Functional braces in contrast cannot correct structural deformities but are widely used for the prevention of deformities, for providing stability, and for the substitution of lacking muscle activity. The construction depends on the occurrence of the deformity (stance or swing phase). Biomechanics are essential. The embedding for controlling the foot and the biomechanical principles and construction errors are explained in detail.

24 JUNE 2022
Rehabilitation Parallel Sessions 1 & 2

36: Understanding Global Developmental Delay

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The first 5 years of a child's life are the most critical in terms of growth and development. Ninety five percent of a child's brain development is completed by the time the child completes its fifth year of life. Many studies have shown that early childhood brain development has a lifelong impact. Given this intensive period of growth, it is discouraged to make final conclusions regarding adaptive and cognitive functioning abilities, amongst other developmental domains. Global Developmental Delay (GDD) is a term coined in the DSM 5 to explain developmental disabilities in children who are under 5 years of age. The DSM (Diagnostic & Statistical Manual), 5th Edition serves as a universal authority for psychiatric diagnoses in many countries across North America, South America, Australia, and many European countries. Developmental domains that are assessed while making a diagnosis include: gross or fine motor skills, speech/language abilities, cognition, social/personal skills, and activities of daily living/adaptive skills. GDD is used for children who have developmental delays across at least 2 or more developmental domains (delay defined as at least 2 standard deviations below the mean in standardized tests) and is reserved for children under 5 years of age who are not able to undergo clinical testing for cognitive functioning and fail to meet particular benchmarks in intellectual functioning clinically. GDD is deemed a temporary diagnosis that warrants intervention and support. The true functioning abilities of a child are assessed again, soonest at age 5 years of age or later, to ensure proper diagnosis and treatment supports for the child and family, as needed. Many children with GDD will end up with a diagnosis of Intellectual Disability in the future, but some do not, especially those that receive early identification services. Global Developmental Delay is typically diagnosed by a specialist such as a trained pediatrician, a developmental-behavioral pediatrician, a child psychologist, or a developmental psychologist. The differential diagnosis often includes developmental delays in different domains, Autism, genetic condition, etc. Investigating for GDD includes a thorough history and physical examination, audiology assessment, ophthalmologic or optometric evaluation, and EEG if seizures are suspected. It is important to note that developmental insults can occur prenatally, perinatally, or postnatally. Depending on the period of insult the cause of the GDD can vary. Prenatally we consider genetic or metabolic concerns, central nervous system malformations, teratogens, toxins, illicit drug use by mother, or infections. Perinatally, things to consider include neonatal asphyxia, prematurity, or other neonatal complications. Postnatally, GDD can be caused by infections, neglect, trauma, or toxins. Sometimes there may not be an identified cause.

37: Robotic Facilitation of the Post-Surgery Gait Rehabilitation in Cerebral Palsy

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Background: There is a wide interest in robot assisted therapy (RAT) in CP children observed in the literature. The goal of the presentation is to assess the effectiveness of RAT in gait related goals achievement in short follow-up and its sustainability in half a year period. The analysis of the demographic, function and previous surgery influence on obtained results was presented.

Patients and methods: 374 CP patients 5-21 y.o. with GMFCS I-IV have been included to the study. All underwent one rehabilitation session for 10 days with exoskeletons and distal -effectors gait

training. The Goal Attainment Scale (GAS) rating was collected just after intervention (short-FU) and at 6 month (long-FU). The obtained results dependence on: age, gender, GMFCS, previous orthopedic surgery and initial GMFM were analyzed.

Results: The total number of 263 patients were included to the study. The initially established goals of RAT at short-FU and 245 patients (65, 51%) at long-FU were obtained. There was no difference in GAS rank between operated (N= 135) and no-operated pts.(N= 128) ($p<0.05$) after RAT both in short and long-FU. The similar results were observed for GMFCS and input GMFM score. For no-operated children the younger (up to 15 y.o) were better therapy responders ,achieved their goals faster, the stability of that achievements were stronger ($p<0.01$). The score of short-FU for boys was higher than for girls ($p<0.01$), but the results sustainability was the same ($p<0.05$).

Conclusion: This large cohort prospective study provides the evidence that RAT in gait related purposes is effective for children with CP, with higher success rate for patients under 15.

38: Motor Learning and Mirror Neuron System: Practical Applications to Improve the Manual Activity and the Gait for Pediatric Physiotherapy

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Introduction: One of the biggest problems afflicting children with CP is autonomy, functionality and velocity of the gait performance. A systematic review on interventions for children with CP founds that context-focused therapy, goal-directed/functional training, occupational therapy following botulinum toxin injection, and home programs improve motor activity performance and/or self-care. Recent discoveries in the neuroscientific field of motor cognition favored the development of a novel approach for the treatment: the Action Observation Therapy (AOT). However, further well-designed, larger controlled trials were suggested to determine the most suitable type of AOT particularly in children. AOT capitalizes on the effects of action observation on mirroring mechanisms and on motor learning, which are already active early in development. fMRI study has explored the cortical reorganization following the AOT, showing an increased activation of premotor and parietal areas; both areas are involved in motor representation and are included in the human mirror system. The μ-frequency band of the EEG is of particular relevance for the evaluation of AOT effects. Its suppression at central electrode sites is considered as an index of neural activation of the underlying sensorimotor cortex. The preliminary findings of a crossover pilot study, suggest that AOT may affect upper limb motor recovery in children with CP and modulate the activation of sensorimotor areas, offering a potential neurophysiological correlate to support the clinical utility of AOT. While AOT in stroke patients is used to recall the memory of the correct movement by action recognition AOT in the child has the aim to stimulate the Mirror Neuron System for motor learning. Given that the child with CP has never experienced what means walking the AOT have to consider the assessment and the training of the preliminary competences of locomotion. Learning manual abilities requires attention in a more explicit way. The working memory supports explicit learning by retaining, recalling, and manipulating task-relevant information over short periods of time. Postural and sway activities get probably learn in a more implicit way. Level of attention and mirroring processes could be enhanced with models more similar to the observer, approximately the same age. Furthermore proposing playful activities, of duration calibrated to the attention abilities of the child could help to keep high levels of interest and motivation, facilitating motor learning.

Aims: Taking inspiration from the latest scientific findings a clinical study has investigated the possible effect of video AOT on gait performance in three children with CP at the Child Neuropsychiatry Unit, ASST dei Sette Laghi, Varese, Italy.

Methods and Participants: A case series multi-baseline design (ABA design) was used. Inclusion criteria were: aged 12 to 18; walks without restrictions (level II of Palisano's classification); able to understand the tasks and researchers' instructions. Children who underwent orthopaedic surgery or Botox injection in lower extremity within 6 months were excluded Three children with CP were conveniently enrolled and assessed 4 time:

one-month (T0) and just before (T1) treatment, immediately after treatment (T2), and 2-months follow up (T3). Main outcome measure was the Edinburgh Visual Gait Score (EVGS). MCID is calculated of 2.4, given that the EVGS correlates closely with the Gait Profile Score GPS and both scores correlate with GMFCS level secondary outcomes were range-of-motion), 6-minute Walking Test, and Goal Attainment Scale.

Results: All the 3 children showed an improvement in gait higher than the MCID (range: 6 to 15 points). The trend showed a slight worsening at follow up although lower than MCID.

Conclusion: Our findings offer interesting insights for clinicians when planning AOT intervention in children, and for researcher to design future studies. A new type of innovative therapy, such as the AOT with an ICT platform, has recently been proposed directly at patients' home. Telerehabilitation and eHealth provide a promising approach to deliver telemonitored home programs for a large number of participants at a relatively low cost.

39: The Rehabilitation Management of Neuromuscular Diseases

Laura Movsisyan
Armenak and Anna Tadevosean's Medical Center, Kosh, Armenia

Progressive acquired or hereditary neuromuscular diseases (NMD) are disorders caused by an abnormality of any component of the lower motor neuron-anterior horn cell, peripheral nerve, neuromuscular junction (presynaptic or postsynaptic region), or muscle ultimately lead to progressive loss of functional muscle fiber over time, which may lead to progressive weakness, decreased endurance, limb contractures, spinal deformity, body composition changes, decrease in mobility, decrease pulmonary function and occasionally cardiac impairment. Genetic defects causing CNS structural protein alterations may lead to intellectual impairment. These diseases affect children and adults with variable onset over the life span and they are progressive with variable severity and rates of progression.

Appropriate rehabilitation management of NMD requires an accurate diagnosis. All diagnostic information needs to be interpreted, not in isolation, but within the context of relevant historical information, family history, physical examination findings, laboratory data, molecular diagnostic studies, electrophysiological findings, and pathologic information, if obtained. The skilled synthesis of all information may provide the patient and family with 1-precise diagnosis 2-prognostic information, 3-anticipatory guidance for the near future

Rehabilitation approach directed at improving impairment, and/or resultant disability may substantially improve the quality of life and community integration of children with NMD. The discussion emphasizes general principles in the rehabilitation management of childhood NMD with several specific conditions used to illustrate key concepts: such as Exercises in NMDs, management of limb contractures and deformity, bracing/orthotic and surgical management of limb deformity, Management of spinal deformity, provision of functional mobility, pulmonary and cardiac complications management, nutrition management. In this presentation we will discuss a management of the most common Childhood Neuromuscular Diseases on the example of Duchenne muscular dystrophy (DMD) and Spinal Muscular Atrophy (SMA).

40: Feeding Assessment in Cerebral Palsy

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Children with CP are at an increased risk of having developmental feeding challenges. Posture, spasticity, oral-motor dysfunction, respiratory and gastrointestinal issues combine to create a multi-faceted functional problem of nutrition, hydration, independence and participation. Difficulties include dysphagia and inefficient, prolonged meals which may lead to undernutrition, poor growth and recurrent pulmonary infections threatening health and developmental potential. In order to prescribe appropriate treatment and feeding guidelines, it is important to be able to correctly evaluate the safety and efficacy of oral feeding. We will describe the validated scales available and specifically introduce the Eating and Drinking Ability Classification System for Individuals with CP (EDACS) which is valid

for use with children and adults with CP from 3 years of age as well as the newly published MiniEDACS for children aged 18 months to 3 years of age. It describes 5 simple actions to evaluate levels of both feeding efficiency and safety, as well as the degree of dependence on a caregiver. The EDACS is comparable to other useful scales in CP evaluation (such as the GMFCS, MACS and CFCS). We will also present the IDDSI – International Dysphagia Diet Standardization Initiative scale for textures as a tool to standardize the description of various foods. We will present the tools and briefly describe the process of translating, validating, and educating the Israeli pediatric rehabilitation and developmental medicine professionals in implementing the scale through our experience at the Alyn Hospital Rehabilitation Center's Feeding Rehabilitation Clinic, which has seen over 1700 patients and provides training to professionals through the Health, Welfare and Education Ministries. At the conclusion of the session, the attendees will be familiar with the scales and have a suggested frame of introducing it into their own systems. We believe that a comprehensive and unified scale will help assess the needs, help guide care and provide the basis for further research.

41: Predicting Pediatric Powered Mobility Intervention across a Range of Abilities

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Learning objectives: Upon completion of this session the participants will be able to:

1. Discuss the importance of powered mobility for children

2. Identify variables that predict powered mobility proficiency

3. Recognize children that could benefit from additional practice time.

Background: Children with physical disabilities may have mobility challenges and be referred to powered mobility as an option for independent mobility. Being able to control a powered wheelchair is a complex skill and ample practice is needed. Some children are able to master the skill while others struggle to gain control and drive in a safe manner.

Goal: To identify variables that can predict which children and young adults become proficient powered wheelchair drivers.

Method: Participants included 80 children and young adults (42 males, 38 females) with neuromuscular disease, CP, and spinal cord injury (mean age: 10y 2mo, SD: 5y 1mo) who completed the Alyn Hospital "Powered Mobility Lending Program" from 2009 to 2016. Data were collected and compared prior to and following participation in the lending program and powered mobility levels were determined by the Israeli Ministry of Health (MOH) Powered Mobility Proficiency Test. Multivariate logistic regression analysis followed by a bootstrapping procedure that was based on 1000 samples were used to determine if the variables were predictive of success on the MOH Test.

Results: Significant variables for predicting success were identified: manual wheelchair propulsion, go-stop voluntarily upon request, and using a joystick. The model was able to correctly identify 80% of the children.

Interpretation: Children and young adults with the ability to go-stop upon request, propel a manual wheelchair short distances, and use a joystick to activate the powered wheelchair had a higher chance to become proficient. Children that used alternative access modes needed additional practice time in the prospect of obtaining proficiency.

42: A New Pediatric Powered Mobility Assessment 3PM: Progression of Pediatric Powered Mobility

Naomi Gefen,[1] Lori Rosenberg[2]
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Aim: Children with CP with mobility limitations often have less opportunity for development; powered mobility (PM) is therefore important for independent mobility as well as development. Field and Livingstone (2018) describe children's driving ability in three stages; exploratory, operational and functional. An assessment according to these stages facilitate individual tailored interventions. The aim of this research was to develop a tool to assess progression of powered mobility skills for children within the framework of the three driving stages and to determine the tool's psychometric properties.

Experimental design: A three-phase, mixed-method design.

Methodology: Phase I) conceptualization based on international specialists' input through a focus group or interview to generate initial items; Phase II) tool development using a two-round Delphi survey and Phase III) evaluation of psychometric properties from eight video recordings of children with CP (Gross Motor Function Classification Scale III-V). Internal consistency of the Pediatric Powered Mobility (3PM) was assessed as were its interrater reliability and convergent validity in comparison to the Powered Mobility Program, Assessment of Learning Powered Mobility tool, Powered Mobility Proficiency test.

Data collection: Qualitative data were collected from the 24 specialists that participated in the focus group or interviews with 21 responses to the first Delphi round and 13 responses the second Delphi round. The quantitative data for reliability and validity of the new assessment was obtained by viewing video recordings of 8 children which 10 therapists rated.

Results: Content from experts led to the development of the first 3PM version (19 demographic and 61 driving skill items). This version was distilled to 14 demographic and 41 driving skill items through the Delphi rounds. The final version of the 3PM, following Field and Livingstone's three driving stages, includes 14 demographic items, 10 exploratory items, 17 operational items and 14 functional items. Internal consistency was excellent (Cronbach alpha= 0.96) as was the interrater reliability (ICC=0.96, 95% confidence interval = 0.95-0.96). Pearson correlation coefficients between the 3PM and other assessments demonstrated good convergent validity.

Conclusions: The 3PM, created through international collaboration, has excellent psychometric values as a valid measure that can be used reliably to assess children's powered mobility skills.

43: Power Fun: A Novel Powered Mobility Intervention for Children with Complex Disabilities

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Aim: Powered mobility (PM) can allow independent locomotion for children with severe CP, enabling engagement in life experiences and development. However, limitations can make leaning PM difficult. Power Fun, an intensive, therapeutic, theory-based PM summer camp, provides a pragmatic solution. The camp protocol includes providing personally adapted powered wheelchairs to use during the camp, which ran 5 days a week for 3 weeks. Children participated in 2 daily mobility sessions with supervision during recess. The aim of the research was to measure: 1) change in PM skills, 2) attainment of personal goals and 3) changes in social interaction following the camp.

Experimental design: A multiple base line, mixed-method quasi-experimental study design using intentional sampling. Inclusion criteria were children with severe CP (GMFCS 4-5, MACS 3-5) ages 7-21 attending special education schools. The camp ran 4 times over 3 summers with 6 children per group

Methodology: PM skill was assessed using Power Mobility Program (PMP) and Assessment of Learning Power mobility use (ALP), goal attainment with Wheelchair Outcome Measure for Young People (WhOM-YP) and Goal Attainment Scaling (GAS) and social interaction through staff and participants interviews. Assessments were conducted

three weeks prior to the camp (T1), at bassline (T2), post-intervention (T3) and three weeks follow-up (T4). Changes over time were analyzed with the General Linear model. Goals were examined by descriptive statistics and interviews using inductive qualitative descriptive method.

Results: 23/24 participants finished the camp. There was a significant improvement in PM skills (PMP: F (1, 26) = 35.49, $p<0.001$; ALP: F (1, 22) = 93.74, $p<0.001$); no changes were seen prior to the camp, but significant improvements were seen post intervention T2-T3 and maintained at T4. Personal goals (n=48) were reached (GAS average 0.2) with was a significant effect over time (WhOM-YP: F (2, 43) = 170, $p<0.001$). All participants reported the camp extremely enjoyable. Staff interviews (n=19) identified 4 overarching themes: (1) "Every step you take: mastering new, unexpected, skills" (2)" Break on through to the other side: changes in behavior" (3)" Make new friends (but keep the old): Boosting social behavior" (4)" I'm a believer: The journey through self-efficacy to empowerment".

Conclusions: Power Fun can promote PM skills for children with severe CP and allow attainment of personal goals while promoting enjoyment, activity, interactions, and self-efficacy.

44: Pediatric Powered Mobility Training: Powered Wheelchair vs. Simulator Based Practice

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Background: Many children with physical disabilities lack independent mobility. Powered wheelchair mobility can be a viable training and practice option, but users must be proficient drivers to ensure safety. To become a proficient driver, children need opportunities to practice. As is often the case, powered wheelchairs are scarce and direct therapy hours dedicated to powered mobility are often limited. Alternative options are needed to enable safe, unsupervised practice. The aim of this study was to compare two training methods of powered mobility, powered wheelchair (control group) versus simulator-based (experimental group) practice to determine whether simulation is a feasible and effective method for children and adolescents.

Methods: Participants included 30 children and adolescents (23 males, 13 females) with CP and neuromuscular diseases, aged 6-18 years (mean age: 10y 7mo, SD: 3y 7mo). Data were collected and compared at baseline and after 12 weeks of home-based practice via a powered wheelchair or a simulator. Powered mobility ability was determined by the Powered Mobility Program (PMP), the Israeli Ministry of Health's Powered Mobility Proficiency Test (PM-PT) and the Assessment of Learning Powered Mobility (ALP).

Results: Both the powered wheelchair and simulator-based practice groups achieved significant improvement following the practice period as assessed by the PMP and PM-PT, with no significant differences between them. A significant improvement was found in the ALP for the powered wheelchair group only. All participants practiced for the required amount of time and both groups reported a similar user experience.

Conclusions: The results demonstrate that simulator-based practice enables children and adolescents with physical disabilities to improve their skills in powered mobility with success comparable to that achieved with the use of a powered wheelchair. Simulator-based practice can provide a safe environment to practice driving skills that could endanger the child (e.g., out of doors). This is the first study, to our knowledge, that compares two different wheelchair training methods.

25 JUNE 2022
General Session

45: Developmental Disability in the 21–st Century: What are We Thinking and Doing About?

Peter Rosenbaum
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Not all revolutions are violent and bloody. As planning for the East European Meeting for Cerebral Palsy and Development Medicine (EEMCPDM) proceeds in the spring of 2022, under the threat of expanding war across the world, less dramatic but in fact very exciting changes are underway on the field of 'childhood disability'. In this talk I would like to share personal perspectives on three themes: (i) factors that have influencing our thinking both in the past and currently; (ii) concepts that aim to bring these new ideas to life; and (iii) evidence that these expanded views of childhood disability are capturing the attention and imagination of colleagues – and families – around the world.

I will begin my talk by reflecting on how 20th-century thinking in health care influenced what we thought about 'childhood disability'. These perspectives – notably our faith in biomedical science to explain everything, and WHO's tentative (1980) interest in 'disability' – may help to explain what we believed, and what we did in our clinical work and research. I will then introduce the WHO's ICF framework for health (2001) as a transformative influence on our modern thinking.

In the second part of the talk, I will discuss how the ICF framework for health encourages us to see our field with fresh eyes. Bringing the ICF to life with the 'F-words for Child Development' has enabled everyone – parents, service providers, researchers, policy makers – to see children with impairments and their lives in an expanded view. In this way of thinking, we can look at – but also beyond – the child, to see them in the context of family and community, and to appreciate the developmental and life-course aspects of their lives. These ideas in turn influence what we do, and how we do it, in our field of 'applied child development'.

'Nice ideas… but do they matter?' In the third part of my talk I will report some of the accumulating experience and evidence that these ways of thinking/talking/doing are having an impact on our field around the world. In so doing, I will try to reassure colleagues that we need not all give up! Rather, we can expand our horizons and do an even better job!

46: Ultrasound Guided Botulinum Toxin u Electric Stimulation Guided Phenol Injections

Beth Padden, Beat Knecht
Children's Hospital, Zurich, Switzerland

Most disabled children and adolescents who are treated in the Rehabilitation Outpatient Clinic of the University Children's Hospital in Zurich suffer from a cerebral movement disorder, many are of spastic and/or dystonic nature. This can lead to a muscular imbalance which often results in contractures and deformities in the upper and lower extremities, especially during growth. These secondary complications may also lead to pain. Often the question arises whether muscle tone and movement disorder management should be expanded to include injections of botulinum toxin or phenol. The indication for treatment is evaluated on an individual basis in the context of current ongoing therapies and other treatment options and must be incorporated in the overall care plan. Thorough examination and functional assessment are used to determine the targeted goals according to impairment and disability. Often decisions to treat are made during multidisciplinary clinics including physical and/or occupational therapists, orthopedic and hand surgeons and rehabilitation specialists. In our pediatric rehabilitation clinic chemical neurolysis

with phenol and neuromuscular blockade with botulinum toxin have been well established for many years as a possible treatment for increased muscle tone. This workshop will give a review on the use of neuromuscular blocking agents botulinum toxin and phenol based on literature and on our own experience. The mechanism of action, indications in upper and lower extremities, applied techniques with ultrasound and EMG, dosage and administration, possible complications, clinical outcomes and legal aspects will be discussed. If time allows we will look at other indications for Botox injections like drooling and bruxism.

47: Spinal Muscular Atrophy Recent Treatment Developments

Antigone Papavasiliou
Department of Neurosciences, Iaso Children's Hospital, Athens, Greece

Spinal muscular atrophy (SMA) is a severe neuromuscular disease with a big impact on affected children and their families. It is a rare condition with an incidence of 1 in 6.000-10.000 live births. It is an autosomal recessive disorder caused by pathogenic variants in SMN1 (Survival Motor Neuron 1 gene), mapped to chromosome 5q13. This results in very low levels of survival motor neuron (SMN) protein, motor neuron loss and subsequent progressive muscle weakness and atrophy of bulbar, skeletal and respiratory muscles. Depending on the age of symptom onset and the maximum motor function achieved, SMA is classified into four main types with different degrees of severity. SMA I, is the most frequent type affecting about 50% of SMA cases and the most serious of all, leading to an early death without treatment. In terms of motor dysfunction, SMA type I patients never sit, SMA II never walk and SMA III walk, but lose ambulation later in life without treatment. In terms of life expectancy, type I children live for about one year, type II survive for over 20 years and type III have normal life expectancy. Without timely diagnosis and treatment, children with SMA may present with severe impairment and early death. There are accepted therapeutic options for patients with SMA, starting with symptomatic treatment, supportive care and specialized physiotherapy, approaches that had an important impact on preventing complications of SMA and improving quality of life. In addition, three therapeutic options involving the SMN genes were approved during the last few years targeting the underlying mechanism of the disease. Nusinersen is an antisense oligonucleotide, targeting exon 7 of the SMN2 gene that enhances the production of functional, full-length SMN protein by the SMN2 gene. It is given intrathecally with loading doses on Days 0, 14, 28 and 63 and quarterly maintenance thereafter. Next, a one-time gene therapy, the drug Onasemnogene abeparvovec-xioi was designed and developed to replace the missing or nonworking SMN1 gene. It is administered via a single, IV infusion. Risdiplam is a drug given orally, that increases the production of complete SMN protein via the SMN2 gene. It is the only treatment that does not require hospitalization. Other disease-modifying treatments are being developed and expected. There are already available data from clinical trials showing a very positive impact of early, pre-symptomatic treatment. An analysis of cost-effectiveness of newborn screening shows improved economic value for both patients and payers because of the significant impact of pre-symptomatic treatment resulting in less severe impairments, fewer associated comorbidities and early death. Despite these tremendous developments, SMA is a challenging disease for health care systems because of the high costs of treatments.

25 JUNE 2022
Orthopedic Parallel Session

48: Management of Spine Deformities in Patients with Neuromuscular Diseases

Kariman Abelin-Genevois
Orthopedic Department, Les Massues Medico-Surgical Center – French Red Cross, Lyon, France

25 JUNE 2022
Rehabilitation Parallel Session

49: Multi-Sectoral Collaboration towards the Disability Inclusive Education

Susanna Tadevosyan
"Bridge of Hope" NGO, Yerevan, Armenia

Community Based Rehabilitation (CBR) focuses on empowerment, rights, equal opportunities and social inclusion of all persons with disabilities. It places special emphasis on the empowerment of persons with disabilities. CBR is an important strategy for inclusive development and in line with UN CRPD to enhance the quality of life of children and youth with disabilities by improving service delivery by providing more equitable opportunities and by promoting and protecting their human rights. According the WHO, the CBR has 5 important components: Health component focusing on promoting wellness, prevention of diseases, medical and rehabilitative care and utilization of assistive technology; Education component focusing on early childhood development, primary, secondary, tertiary and non-formal education and lifelong learning, the Livelihood component focusing on skill development, self-employment, paid employment, financial services and social protection, the Social component focusing on personal assistance, relationships, marriage and family, culture, religion, arts and sports recreation, leisure and access to justice and the Empowerment component focusing on advocacy and communication, community mobilization, political participation, self-help groups and disabled people organizations. Though the CBR, as a framework, is not largely recognized and used in Armenia yet, the "Bridge of Hope" NGO has used the CBR framework as a tool and holistic approach in working towards the disability right advocacy and inclusive development perspectives, at both community and policy levels. The CBR concept is used as a meaningful tool for "Bridge of Hope" development work for provision of community-based rehabilitation services (medical, social, vocational), advancement of inclusive education and empowerment of parents of children with disabilities and persons with disabilities themselves. This presentation is aimed at presenting the "Bridge of Hope" experience and the best practices in advancement of the human rights of persons with disabilities in Armenia by using the CBR as a holistic framework to enhance long lasting and sustainable changes in Armenian policies and development agenda ensuring the rights of children and youth with disabilities to health, education, employment and independent living.

50: Integration Program for Children with Special Needs

Eka Horstka, Ani Adilkhanyan
Voskeporik Development Center,
Yerevan, Armenia

Artissimo NGO has been operational in the Martuni and Yeghegnadzor regions of Armenia for over five years, implementing programs addressing the rehabilitation and reintegration needs of children with physical and mental disabilities. Artissimo NGO founded the Voskeporik Development Center in 2017 to work with children with disabilities (CWD), their parents, and the whole community. The aim of the Center is to promote inclusiveness and enable integration of CWD, educate parents on their children's needs and capacities, and provide access to rehabilitation therapies for children.

51: What Do We Need to Do to Improve Lives of Disabled Children?

Garen Koloyan
Wigmore Clinic, Yerevan, Armenia

Children with disabilities need similar things as healthy children, but a little more. These children need to grow in the families with parents (biological or adopted) and siblings, but not in the orphanages. They need to have an access to education and there is a need of special trained educators to work with them. They also need a good quality health care and special equipment to minimize their disability. Both education and health care require extra funds, which should be provided by state and can be collected by donors (individuals or organizations). Children with disabilities need special laws to protect their rights and give the opportunity for education and treatment. There is a great need of different NGO's supporting children with their medical, social and psychological rehabilitation, education, helping them with sport activities and having fun as well as fighting for their rights with the state. But above of that children with disabilities need love. They need love in their families, they need love at schools and from their classmates and friends, and they need love from health care providers and government people who are working on the policy for disabled. With love it will be possible to make many changes and improve quality of lives of many disabled children.

PROGRAM

9th East European & Mediterranean Meeting for Cerebral Palsy & Development Medicine

22-25 June 2022

22 June 2022

Picasso Hall	**Gait Analysis Pre-Course 1st**		
	08:00 – 09:00	Normal Gait and How Can We Study It	Davit Sekoyan (Armenia)
	09:00 – 09:15	Questions & Discussion	
	09:15 – 10:15	How Gait Disorders Develop in CP Patients	Reinald Brunner (Switzerland)
	10:15 – 10:30	Questions & Discussion	
	10:30 – 11:30	How Reliable is the Clinical Exam when Deciding on Functional Correction	Michael Aiona (USA)
	11:30 – 11:45	Questions & Discussion	
	11:45 – 12:30	**Coffee break**	
	Gait Analysis Pre-Course 2nd		
	12:30 – 13:15	What Can We Learn From Gait Analysis for Decision Making and Case Discussion of Patient with Spastic Diplegia	Reinald Brunner (Switzerland)
	13:15 – 13:30	Questions & Discussion	
	13:30 – 14:00	A Case Discussion of Patient with Spastic Hemiplegia	Michael Aiona (USA)
	14:00 – 14:30	Case Discussion from Audience	
18:00 – 19:00	**Welcome Reception**		

23 June 2022

Ball Room	08:30 – 09:00	**Opening remarks**	
	Moderators:	**Garen Koloyan, Nana Tatishvili**	
	09:00 – 09:30	History of EEMCPD Meetings (Prerecorded)	Michael Sussman (USA)
	09:30 – 10:30	Introduction to Cerebral Palsy (Prerecorded)	
	10:30 – 11:00	Etiology of Cerebral Palsy and Risk Factors	Antigone Papavasiliou (Greece)
	11:00 – 11:30	Early Diagnosis and Early Intervention in Cerebral Palsy	Nana Tatishvili (Georgia)
	11:30 – 12:00	**Coffee Break**	

Ball Room			
	Orthopedic Parallel Session 1st		
	Moderators:	**Uri Givon, Marek Jozwiak**	
	12:00 – 12:30	Hip Surveillance in CP Patients	Uri Givon (Israel)
	12:30 – 13:00	Hip Reconstruction and Salvage Treatment Options in CP Patients	Freeman Miller (USA)
	13:00 – 13:30	Dega Osteotomy in Spastic Hip Disease	Marek Jozwiak (Poland)
	13:30 – 14:00	Orthopedic Considerations for Standing Training in Neuromuscular Conditions	Marek Jozwiak (Poland)
	14:00 – 15:00	**Lunch**	
	Orthopedic Parallel Session 2nd		
	Moderators:	**Caroline Leclercq, Davit Abrahamyan**	
	15:00 – 15:30	Upper Extremity Treatment Options	Freeman Miller (USA)
	15:30 – 16:00	Decision Making in Surgery in Upper Limb Spasticity	Caroline Leclercq (France)
	16:00 – 16:30	What is the Role of Surgery in Upper Limb Spasticity	
	16:30 – 17:00	Pediatric Hand Palsy: Brachial vs. Cerebral	Davit Abrahamyan (Armenia)

Picasso Hall			
	Rehabilitation Parallel Session 1st		
	Moderators:	**Nana Tatishvili, Biayna Sukhudyan**	
	12:00 – 12:30	Follow-up Care of High Risk Infants (Prerecorded)	Tamar Chorbadjian (USA)
	12:30 – 13:00	Rett Syndrome	Ani Gevorgyan (Armenia)
	13:00 – 13:30	Management of Orthopedic Problems in Children with Rett Syndrome	Uri Givon (Israel)
	13:30 – 14:00	Outcome of Pediatric Stroke	Nana Tatishvili (Georgia)
	14:00 – 15:00	**Lunch**	
	Rehabilitation Parallel Session 2nd		
	Moderators:	**Biayna Sukhudyan, Gayane Zakaryan**	
	15:00 – 15:15	Recognizing Autism, Autism Spectrum Disorders, and Neurodiveristy (Prerecorded)	Tamar Chorbadjian (USA)
	15:15 – 15:30	Sensor Processing and Autism Spectrum Disorders (ASD)	Gayane Zakaryan (Armenia)
	15:30 – 15:45	Autism Spectrum Disorder: Early Intervention Strategies	Narine Vardanyan (Armenia)
	15:45 – 16:15	Epilepsy in CP (Seizure Types, Application of the New Classification, Management)	Biayna Sukhudyan (Armenia)
	16:15 – 16:45	Ketogenic Diet for Epilepsy (Prerecorded)	Arthur Partikian (USA)
	16:45 – 17:00	Discussion	

24 June 2022

Ball Room	**General Session**		
	Moderators:	**Freeman Miller, Beat Knecht**	
	09:00 – 10:00	A Win-Win Situation: Pediatric Orthopedics and Pediatric Rehabilitation	Beat Knecht (Switzerland)
	10:00 – 10:30	Clinical Diagnosis and Different Subtypes of Cerebral Palsy, Including Appropriate Diagnostic Work-Up (Prerecorded)	Arthur Partikian (USA)
	10:30 – 11:00	MRI Findings in Cerebral Palsy	Antigone Papavasiliou (Greece)
	11:00 – 11:30	Managing Spasticity	Freeman Miller (USA)
	11:30 – 12:00	**Coffee Break**	
Ball Room	**Orthopedic Parallel Session 1st**		
	Moderators:	**Garen Koloyan, Michael Aiona**	
	12:00 – 12:30	Crouch Gait: Natural History and Treatment	Freeman Miller (USA)
	12:30 – 13:00	Knee Joint Contractures in Functional CP Patients	Reinald Brunner (Switzerland)
	13:00 – 13:30	Rotational Deformities in CP Patients	Michael Aiona (USA)
	13:30 – 13:45	Patella Tendon Shortening for Knee Flexion Contractures in CP Patients	Garen Koloyan (Armenia)
	13:45 – 14:00	The Treatment of Knee Flexion Contractures in Children with Cerebral Palsy	Pavel Rakhman (Ukraine)
	14:00 – 15:00	**Lunch**	
	Orthopedic Parallel Session 2nd		
	Moderators:	**Reinald Brunner, Marek Jozwiak**	
	15:00 – 15:15	Hamstring Lengthening vs. Hamstring Transfer (Prerecorded)	Michael Sussman (USA)
	15:15 – 15:30	Longterm Outcome of Bilateral CP Patients Treated with Hamstrings Lengthening	Bidzina Kanashvili (Georgia)
	15:30 – 15:45	Equinovalgus Deformities in Children with Cerebral Palsy	Vahe Yavryan (Armenia)
	15:45 – 16:00	Treatment of Equino-Varus Deformities in CP Children	Davit Sekoyan (Armenia)
	16:00 – 16:15	Discussion	
	16:15 – 17:00	Braces for Foot Deformities	Reinald Brunner (Switzerland)

Picasso Hall			
	Rehabilitation Parallel Session 1st		
	Moderators:	**Laura Movsisyan, Antigone Papavasiliou**	
	12:00 – 12:30	Understanding Global Developmental Delay (Prerecorded)	Tamar Chorbadjian (USA)
	12:30 – 13:00	Robotic Facilitation of the Post-Surgery Gait Rehabilitation in Cerebral Palsy	Marek Jozwiak (Poland)
	13:00 – 13:30	"Motor Learning and Mirror Neuron System": Practical Applications to Improve the Manual Activity and the Gait for Pediatric Physiotherapy	Anna Anzani (Italy)
	13:30 – 14:00	The Rehabilitation Management of Patients with Neuromuscular Disorders	Laura Movsisyan (Armenia)
	14:00 – 15:00	**Lunch**	
	Rehabilitation Parallel Session 2nd		
	Moderators:	**Laura Movsisyan, Maurit Beeri**	
	15:00 – 15:30	Feeding Assessment in Cerebral Palsy	Maurit Beeri (Israel)
	15:30 – 16:00	Predicting Pediatric Powered Mobility Intervention across a Range of Abilities	Naomi Gefen (Israel)
	16:00 – 16:20	A New Pediatric Powered Mobility Assessment - 3PM: Progression of Pediatric Powered Mobility	
	16:20 – 16:40	Power Fun: A Novel Powered Mobility Intervention for Children with Complex Disabilities	Lori Rosenberg (Israel)
	16:40 – 17:00	Pediatric Powered Mobility Training: Powered Wheelchair vs. Simulator Based Practice	Naomi Gefen (Israel)
	18:00 – 19:00	**Gala Dinner**	

25 June 2022

Ball Room			
	General Session		
	Moderators:	**Beat Knecht, Antigone Papavasiliou**	
	09:00 – 10:00	Developmental Disability in the 21st Century: What are We Thinking and Doing about (Prerecorded)	Peter Rosenbaum (Canada)
	10:00 – 11:30	Ultrasound Guided Botulinum Toxin & Electric Stimulation Guided Phenol Injections	Beth Padden (Switzerland)
	11:30 – 12:00	Spinal Muscular Atrophy – Recent Treatment Developments	Antigone Papavasiliou (Greece)
	12:00 – 12:30	**Coffee Break**	

Ball Room	Orthopedic Parallel Session		
	Moderators:	**Kariman Abelin-Genevois, Freeman Miller**	
	12:30 – 13:30	Management of Spine Deformities in Patients with Neuromuscular Diseases	Kariman Abelin-Genevois (France)
	13:30 – 14:30	Discussion of Cases	

Picasso Hall	Rehabilitation Parallel Session		
	Moderators:	**Susanna Tadevosyan**	
	12:00 – 13:00	Multi-Sectoral Collaboration towards the Disability Inclusive Education	Susanna Tadevosyan (Armenia)
	12:40 – 13:20	Integration Program for Children with Special Needs	Eka Horstka, Ani Adilkhanyan (Armenia)
	13:00 – 13:30	What Do We Need to Do to Improve Lives of Disabled Children	Garen Koloyan (Armenia)

9TH EAST EUROPEAN AND MEDITERRANEAN MEETING FOR CEREBRAL PALSY & DEVELOPMENT MEDICINE

22-25/06/2022
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