



# Department Of Orthopaedics & Traumatology Queen Mary Hospital University Of Hong Kong Medical Centre Newsletter



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## Treatment of Spasticity in DKCH

W Chow, Senior Medical Officer  
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### Introduction

The paediatric orthopaedic service of our department is mainly located in the Duchess of Kent Children's Hospital, which is the only children hospital in this locality. It provides comprehensive, coordinated care for children and young adults with musculoskeletal diseases. It provides a team approach which draws in multiple medical specialists including paediatric orthopaedic surgeons, paediatric neurologists, physical therapists, occupational therapists, social workers, and advanced technology available for treating difference paediatric orthopaedic problems.

### What is spasticity?

One of the commonest problems managed in this hospital is spasticity, which is commonly seen in children with cerebral palsy, brain or spinal cord injury. Spasticity is used to describe abnormal muscle tone or muscles that have too much stiffness. Every muscle has a normal amount of resistance to movement. Spasticity is velocity-dependent resistance, meaning the amount of spasticity changes with how fast the muscle is stretched. If we move a joint slowly,

we see less resistance than if we move it quickly. However, spasticity is always present. Spastic muscles usually are stiffer when the person is awake than when the person is sleeping. Spasticity can limit movement and interfere with daily living. It can cause debilitating complications such as deformity of the spine, contractures of the joints that will affect the patient's ambulation. Spasticity cannot be cured. However, often it can be treated or managed so as to minimize its adverse effect on the musculoskeletal system.

### TREATMENT OF SPASTICITY

#### The Team Approach

The treatment usually starts with a detailed evaluation of the children by a team including the paediatric orthopaedic surgeons, paediatric neurologists, physical therapists, occupational therapists and social workers. Team members help define the tone abnormality, adverse effect caused and recommend treatment

**Motion Analysis Laboratory:** If the child can walk, he or she will be further evaluated in DKCH Motion Analysis Laboratory. Here, physical therapists and orthopaedic surgeons analyze muscle, joint and nerve problems that affect a patient's walking ability.

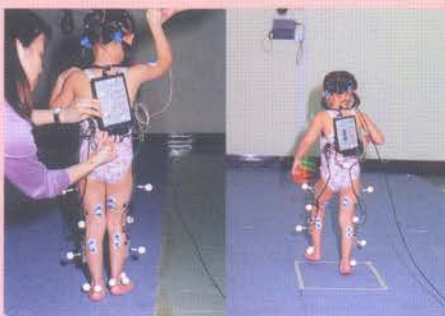


Fig. 1 Electrodes are placed on the child's skin surface and are used to monitor electrical activity of the muscles as the child walks.

Electrodes are placed on the child's skin surface and are used to monitor electrical activity of the muscles as the child walks. (Fig. 1) Force plates built into the floor record the balance, direction and weight

distribution. Cameras and computers record the data. The child's walking cycle is reproduced onto a computer graph for analysis. (Fig. 2) This motion analysis provides information about the characteristics of the muscle tone problem, whether there are any bone deformities affecting the child's ability to move and allows doctors to crystallize effect of abnormal muscle on the joints in motion. Information on the effectiveness of energy generation during walking can be obtained. This information can be essential in determining the most appropriate treatment for the optimal outcomes for the child.



Fig. 2 The child's walking cycle is reproduced onto a computer graph for analysis.

Treatment options for spasticity include:  
**PHYSICAL THERAPY** The goal of therapy is to help children with spasticity be as functional as they can be. Therapy includes range-of-motion exercises to keep the joints flexible, strengthening and stretching exercises to maintain muscle length.



Fig. 3 Nighttime abduction brace to stretch out and maintain the length of the adductor muscle.

**ORTHOTICS OR BRACES** Orthotics or braces can help support muscles and joints in more functional positions and help with stretching the muscles through prolonged positioning (Fig. 3).

**CASTING** Casting is used to stretch the muscle for a prolonged period of time to help increase range of motion. Casting is commonly coupled with another intervention such as medication or surgery to help increase the impact of the treatment.

**MEDICATION** Medication may be recommended as a treatment option if physicians determine that spasticity is limiting a child's ability to function. It may be used in conjunction with bracing, exercises and casting. Oral **Baclofen** is the most commonly used medication to help relax muscles or reduce muscle tone. The site of action for Baclofen is the spinal cord. To be effective, the dose must be large enough to travel through the blood stream and cross what is called the blood/brain barrier that basically keeps chemicals from getting to the brain and spinal cord. However, high doses will also cause side effects that limit its application.

**Botulinum type A toxin** (also known as **Botox**) is frequently used in DKCH in treatment of spasticity in patients with cerebral palsy. They are expensive but the injections are easy to administer to a child and have few side effects. It can improve the patient's ability to move, allow for braces to fit better and increase the ease of stretching.

Botox causes the spastic muscles to relax for about six months. During this time, the physical therapist will work with the child to stretch the relaxed muscle and help it grow to reduce contracture and bone deformity. Intervention at appropriate time will facilitate training and learning of different functional skills for daily activities.

## SURGERY

Surgery is used to treat significant spasticity after other non-surgical treatments are tried and if the spasticity continues to be problematic. Some surgeries require significant post-operative rehabilitation and the child's ability to participate is an important consideration.

### Intrathecal Baclofen Pump

A test dose of intrathecal Baclofen can first be given so both the doctor and patient can closely monitor the change of muscle tone. If the patient and doctor agree that the intrathecal Baclofen was beneficial, and there

are no problems with side effects, the patient may be a candidate for an intrathecal Baclofen pump (ITB). With ITB, Baclofen is dispensed directly into the area around the spinal cord – the intrathecal space. Baclofen can be given in significantly smaller doses through the pump than with oral Baclofen and ITB reduces spasticity more effectively and with minimal side effects.

Surgery is required to implant the pump under the skin of the abdomen and a catheter connects it to the spine. The pump can be programmed to release a specific amount of medicine at select times. The dose can be adjusted without surgery. The pump needs to be refilled in the theatre under no anesthesia every one to three months. Additional therapy may be recommended so the child can learn how to move better with his or her reduced spasticity.

### Selective Dorsal Rhizotomy Surgery

DKCH currently uses selective dorsal rhizotomy to permanently reduce spasticity. Rhizotomy surgery involves operating on the nerve rootlets near the spinal cord that come from sensory nerves in the legs (Fig. 4 and 5). With rhizotomy surgery, patients will have significantly reduced spasticity, be able to walk farther, and walk with more endurance while using less energy (if they were able to walk prior to surgery).

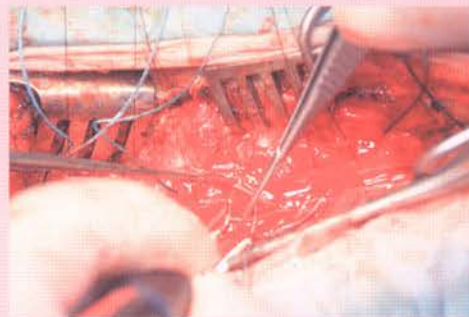


Fig. 4 Posterior spinal rootlets with abnormal intraoperative EMG signals were cut.



Fig. 5 Needle electrodes are inserted into individual muscle of the lower limbs to detect abnormal EMG signal upon stimulation of the spinal rootlets.

Candidates for rhizotomy surgery are chosen carefully. The ideal candidate:

- Is between the ages of 4 and 6 and has cerebral palsy.
- Has pure spasticity without other types of muscle tone problems.
- Has underlying control of their movement (they can move a muscle but the tone is interfering with them using it effectively).
- Has spastic muscles, primarily in the legs (spastic diplegia), spasticity in the legs and arms with the legs more affected (spastic quadriplegia), or spasticity involving the arm and leg on the same side of the body (spastic hemiplegia).
- Has spasticity that either interferes with his or her ability to function or interferes with a caretaker's ability to care for the person.
- Has good motivation and the ability to cooperate with a long-term therapy program.
- Has a family who understands the long-term commitment to intensive physical therapy.

Even though a person may not meet all of these criteria, he or she still may be a candidate for rhizotomy surgery.

### Bone and Soft tissue surgeries

Bone and soft tissue surgeries are not for managing spasticity but instead are used to help correct the problems of muscle imbalance, contractures and bone deformities that are caused by spastic muscles. Correction of the contractures and deformity by soft tissue release, tendons transfer and bony surgery usually enhances the gait pattern and posture of the patient (Fig. 6).



Fig. 6 Derotation osteotomy of the proximal femur to correct excessive femoral internal torsion.

# Seating Service in Occupational Therapy for Neuromuscular Patients

By Karlen Law, Occupational Therapist, DKCH

Children with severe neuromuscular disease, including Cerebral Palsy, Muscular Dystrophy, Spinal muscular Atrophy, and Spinal Cord Injury, are unable to walk or even sit properly on a chair. Most of them are bed-ridden and need to be carried by their caretakers. They are deprived of normal play and learning through their environment. Due to the improper seating posture, problems are induced in breathing, feeding, pressure sore, soft tissue contractures and skeletal deformities. In other words, their function in the activities of daily living (ADL), work and leisure are hindered.

The commonest problems among the neuromuscular patients, which hinder their seating, are:

- Imbalance of tone causes abnormal movement pattern which is usually initiated by the neck movement
- Spinal deformities will be secondary to the abnormal tone
- Pelvic deformity, such as obliquity, rotation and wind-swept deformity
- Subluxation of the hips due to spasticity of hip adductors
- Leg length discrepancy due to both the supra-pelvic and infra-pelvic causes
- Hamstring deficit due to spasticity
- Ankle and foot deformity due to muscle imbalance



In the "Seating Service", Occupational Therapists aim at:

- normalizing the muscle tone by controlling the abnormal pattern of movement through positioning
- improving the posture and trunk stability in maintaining the neutral skeletal alignment for function,
- improving the pressure distribution, comfort and cosmesis which in turn improve the sitting tolerance in the daily activities.

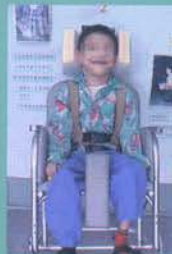
Position and support the head in neutral or midline by :

- Tailor-made head support (diagrams on the right)

- Occipital support complex of the Whitmyer Head support system on the right diagram



Pre-



Post-



With head support



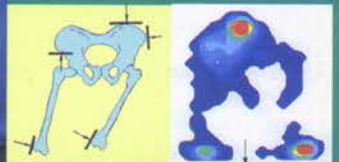
Without head support

Control the flexible spinal deformity by means of :

- Gravitational force in the Tilt-in-space seating system
- 3-point supporting system by Bracing or Lateral supports in addition to the Pelvic blocks and Pelvic stabilizer
- position into the Reflex Inhibiting Posture to break the abnormal movement pattern



- Prevent the pressure sores resulting from the uneven pressure distribution of the pelvic deformities, such as windswept deformity shown in the diagram
- Reduce the flexible deformities by the appropriate seat base, pommel, thigh guard, hip guard and the gel pad
- Even out the pressure in terms of the total contact area and the strength of the pressure under the monitoring of the Tekscan Clinseat Pressure Mapping System



- Control the flexible ankle and foot deformities by the knee blocks and heel guards and straps



To optimize the clinical effect of the seating system, training for patients and their caretakers will be provided to ensure the proper application of the system.

The plain radiograph shows transverse fracture of the distal third of the radial shaft associated with angulation and overriding of the distal fragment. There is disruption of the distal radioulnar joint with the distal ulna dorsally displaced. Findings are that of Galeazzi fracture-dislocation.

When fracture of one of the paired long bones is associated with bone shortening, one has to be wary of concomitant distortion in the joint proximally or distally. In Galeazzi fracture-dislocation, proximal displacement of the distal radius leads to foreshortening of the radius in relation to the ulna with associated disruption of the triangular fibrocartilage allowing subluxation/dislocation of the distal radioulnar joint. Treatment by open reduction and internal fixation is often required due to high incidence of non-union and redislocation if treated by closed method.



Practically, a proper seating system alone does not directly lead to quality life. To

optimize the ability of this group of children, with severe disability, controlling the environment will be another important concern. Therapist will explore the feasibility in applying the assistive technology in optimizing their function, such as Environmental Control unit, etc.

With the help of the individualized design of the seating system, patients can sit out during the daily activities and start to have control in their ADL function. Therefore, it improves the participation in their social environment, which may lead a better "Quality of life".

## Donations

A generous sum of HK\$500,000 was donated by Dr Wong Bing Lai and his sons, Messrs Wong Tat Chang Abraham, Wong Tat Kee David and Wong Tat Sum Samuel, to establish the **Dr Wong Bing Lai Research and Development Fund in Orthopaedic Surgery**. The fund will be used for academic, research and training developments in orthopaedic surgery and related disciplines.

## Radiographic Quiz

Dr. L.L.S. Wong  
Department of Radiology  
Queen Mary Hospital



A 25-year-old male presented to the A&E department after falling on his outstretched left hand in the basketball game. Plain radiograph was taken.

What injury is shown on the plain radiograph?

## News in Flash

Congratulations to Professor Keith DK Luk on being promoted to Personal Professor in the Department of Orthopaedic Surgery. Professor Luk graduated in 1977 from the University of Hong Kong. His vast and keen interest in orthopaedic surgery is reflected by his numerous international and regional publications. He is well known both internationally and regionally in the field of spinal surgery. He was also President of the Hong Kong Orthopaedic Association from 1993-1994 and President of the Hong Kong College of Orthopaedic Surgeons from 1999-2000.



Professor Keith DK Luk

Congratulations to Dr Daniel Yip on his successful application of research grant from Queen Mary Hospital Charity Ltd Transplant Training and Research Assistance Scheme (TTRAS). The title of his research project is "To evaluate biomechanically the strongest host bone and allograft bone docking site geometry for application in bone transplant patients undergoing limb salvage surgery".

Congratulations to Dr Kenneth Cheung who has been recently successful in obtaining a HK\$1.5 million grant from the Hong Kong Research Grants Council to

work on the project "Genetic basis of degenerative disc disease in Chinese". The project aims to identify people with mutations that may predispose them to intervertebral disc degeneration that may result in back pain and sciatica.

A Workshop on "PCL reconstruction using a Two Tunnel technique" was successfully held at the Gait Laboratory of Duchess of Kent Children Hospital on 11<sup>th</sup> June 2001. Dr. David Caborn from the University of Kentucky Sports Medicine Centre USA came to demonstrate the special technique, which was believed to give a better result than that of using the conventional one tunnel technique.

On 1<sup>st</sup> June 2001, the Division of Joint Replacement Surgery organized a one-day symposium on total hip replacement. The guest speaker was Dr. TP Schmalzreid from California, USA. Dr. Schmalzreid gave several talks, including his works that had won important international prizes. He also demonstrated two cementless total hip replacements. The event was attended by over 50 persons, ranking from trainees to very senior consultants. The participants were most impressed not only by the academic aspects of the symposium, but also by Dr. Schmalzreid's outstanding stature of 6 feet and 10 inches!



Total Hip Replacement Symposium