BRITISH SOCIETY FOR SURGERY OF THE HAND

Instructional Courses in Hand Surgery

Tendon Injury, Paralysis, Rehabilitation

2 – 3 February 2018

Series 7, Course 3
Instructional Courses Series Seven 2017 – 2019
Meeting 7.3: Tendon Injury, Paralysis, Rehabilitation
Manchester Conference Centre
2 – 3 February 2018

Organising Committee:

| L Muir       | Z Naqui                     |
| D J Shewring | M Pickford                  |
| D J Brown    | G D Smith                   |
| V Bhalaik    | M Calcagni, FESSH Representative |
| G Bourke     | S Fleming, BOTA Representative |
| F Iwuagwu    | R Mistry, PLASTA Representative |

2 February 2018

Dear Speaker/Participant,

Welcome to the third meeting of the seventh series of the Instructional Courses in Hand Surgery and to the Manchester Conference Centre.

The trade stands will be located in the Pioneer Room, where refreshments and lunch will be served on both days.

We would be most grateful if all participants visit the exhibition stands. I am sure you will appreciate that their attendance helps support these courses.

Since the introduction of online registration for the Instructional Courses, we no longer send out the programme and other details in advance. Information about the course can be found at:

http://www.bssh.ac.uk/about/events/2113/ichs_73_tendon_injury_paralysis_rehabilitation

Please note that the Saturday session will run differently this year. Each delegate has been allocated a group number which is displayed on your name badge. Groups have individual programmes for the day, which will be available from the registration desk, and will rotate around 8 case study stations.

I will be present throughout the two days and if you have any queries, please do not hesitate to contact me.

Yours faithfully,

Charlotte Smith
Events and Committee Coordinator
### Instructional Courses in Hand Surgery

#### 7.3: Tendon Injury, Paralysis, Rehabilitation

**Manchester Conference Centre**

**2 - 3 February 2018**

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**Friday 2 February**

<table>
<thead>
<tr>
<th>Time</th>
<th>Duration</th>
<th>Session</th>
<th>Faculty</th>
<th>Room</th>
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</thead>
<tbody>
<tr>
<td>08:15</td>
<td></td>
<td>Registration and refreshments</td>
<td></td>
<td>Lower foyer [outside Pioneer Theatre]</td>
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<tr>
<td>08.50</td>
<td></td>
<td>Introduction</td>
<td>Mr Lindsay Muir</td>
<td>Pioneer Theatre</td>
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**Flexor tendons**

**Chairman: Miss Gill Smith**

<table>
<thead>
<tr>
<th>Time</th>
<th>Duration</th>
<th>Session</th>
<th>Faculty</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>09.00</td>
<td>15</td>
<td>Suture materials and biomechanics of tendon sutures</td>
<td>Mr Vijay Bhalaik</td>
<td>Pioneer Theatre</td>
</tr>
<tr>
<td>09.15</td>
<td>15</td>
<td>Principles of flexor tendon repair including choice of suture, number of strands and epitendinous, configuration of strands</td>
<td>Professor Jin Bo Tang</td>
<td>Pioneer Theatre</td>
</tr>
<tr>
<td>09.30</td>
<td>15</td>
<td>Management of pulleys when to vent, management of tendons in zone 2 when to strip tendon;</td>
<td>Professor Jin Bo Tang</td>
<td>Pioneer Theatre</td>
</tr>
<tr>
<td>09.45</td>
<td>15</td>
<td>Tips and tricks, including spaghetti wrist, how to manage Camper’s chiasma</td>
<td>Mr Mark Pickford</td>
<td>Pioneer Theatre</td>
</tr>
<tr>
<td>10.00</td>
<td>15</td>
<td>Rehab of flexor tendon injury including physiology</td>
<td>Mrs Alison Roe</td>
<td>Pioneer Theatre</td>
</tr>
<tr>
<td>10.15</td>
<td>15</td>
<td>Evidence in flexor tendon injury surgery</td>
<td>Mr Thomas Giesen</td>
<td>Pioneer Theatre</td>
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<tr>
<td>10.30</td>
<td>15</td>
<td>Questions</td>
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<th>Time</th>
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<tr>
<td>10.45</td>
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<td>Refreshment break</td>
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<td>Pioneer Room</td>
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**Amputations and extensor tendon injury**

**Chairman: Mr Fortune Iwuagwu**

<table>
<thead>
<tr>
<th>Time</th>
<th>Duration</th>
<th>Session</th>
<th>Faculty</th>
<th>Room</th>
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</thead>
<tbody>
<tr>
<td>11.10</td>
<td>10</td>
<td>Amputations principles, with particular reference to tendons. Only CMC joint and distal</td>
<td>Mr Zaf Naqui</td>
<td>Pioneer Theatre</td>
</tr>
<tr>
<td>11.20</td>
<td>15</td>
<td>Mallet finger and mallet fracture and open mallet finger incl Seymour #</td>
<td>Miss Alexandra Hazelrigg</td>
<td>Pioneer Theatre</td>
</tr>
<tr>
<td>11.35</td>
<td>20</td>
<td>Extensor tendon injuries and tendon imbalance, including contractures and intrinsic problems</td>
<td>Mr Anuj Mishra</td>
<td>Pioneer Theatre</td>
</tr>
<tr>
<td>12.00</td>
<td>15</td>
<td>Extensor tendon adhesions - tips and tricks</td>
<td>Mr Thomas Giesen</td>
<td>Pioneer Theatre</td>
</tr>
<tr>
<td>12.15</td>
<td>20</td>
<td>Management of central slip and boutonniere</td>
<td>Mr Mark Pickford</td>
<td>Pioneer Theatre</td>
</tr>
<tr>
<td>12.35</td>
<td>20</td>
<td>Management of swan neck</td>
<td>Miss Grainne Bourke</td>
<td>Pioneer Theatre</td>
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<tr>
<td>Time</td>
<td>Duration</td>
<td>Event</td>
<td>Speaker(s)</td>
<td>Venue</td>
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<tr>
<td>12.55</td>
<td>15</td>
<td>Questions</td>
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<tr>
<td>13.10</td>
<td>55</td>
<td>Lunch</td>
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<td>Pioneer Room</td>
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<tr>
<td></td>
<td></td>
<td><strong>CVA and CP and tetraplegia</strong></td>
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<tr>
<td><strong>Chairman: Miss Grainne Bourke</strong></td>
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<tr>
<td>14.05</td>
<td>20</td>
<td>Cerebral palsy and hemiplegia a neurology view</td>
<td>Dr Krystyna Walton</td>
<td>Pioneer Theatre</td>
</tr>
<tr>
<td>14.25</td>
<td>20</td>
<td>Assessment and non surgical treatment CP and hemiplegia</td>
<td>Dr Krystyna Walton</td>
<td>Pioneer Theatre</td>
</tr>
<tr>
<td>14.45</td>
<td>20</td>
<td>Principles of management of CP</td>
<td>Dr Caroline Leclercq</td>
<td>Pioneer Theatre</td>
</tr>
<tr>
<td>15.05</td>
<td>20</td>
<td>Principles of management of spasticity</td>
<td>Dr Caroline Leclercq</td>
<td>Pioneer Theatre</td>
</tr>
<tr>
<td>15.25</td>
<td>15</td>
<td>Questions</td>
<td></td>
<td></td>
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<tr>
<td>15.40</td>
<td>30</td>
<td>Refreshment break</td>
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<td>Pioneer Room</td>
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<tr>
<td><strong>CVA and CP and tetraplegia</strong></td>
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<tr>
<td><strong>Chairman: Mr Mark Pickford</strong></td>
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<tr>
<td>16.10</td>
<td>20</td>
<td>Principles of management of hemiplegia</td>
<td>Miss Gill Smith</td>
<td>Pioneer Theatre</td>
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<tr>
<td>16.30</td>
<td>20</td>
<td>Principles of management of Tetraplegia</td>
<td>Mr Simon Pickard</td>
<td>Pioneer Theatre</td>
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<tr>
<td>17.00</td>
<td>20</td>
<td>Questions</td>
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<tr>
<td>17.20</td>
<td>10</td>
<td>Preview of June course</td>
<td>Mr Lindsay Muir</td>
<td>Pioneer Theatre</td>
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<tr>
<td>17.30</td>
<td>10</td>
<td>Introduction to Saturday</td>
<td>Mr Lindsay Muir</td>
<td>Pioneer Theatre</td>
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<td>17.40</td>
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Saturday 3 February

*Delegates will be split into 8 groups and will rotate between the following rooms below. Group numbers will be displayed on name badges. Please see individual group programme (which will be available from the registration desk) for timings.

<table>
<thead>
<tr>
<th>Time</th>
<th>Session and Faculty</th>
<th>Room</th>
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<tbody>
<tr>
<td>07:45</td>
<td>Registration and refreshments</td>
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<td>08.00</td>
<td>Rotation between the following stations; each station 40 minutes; 10 minute gap to ensure smooth progression</td>
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<tr>
<td></td>
<td>CP cases</td>
<td>Miss Catherine Hernon</td>
</tr>
<tr>
<td></td>
<td>CVA and tetraplegia cases</td>
<td>Mr Simon Pickard</td>
</tr>
<tr>
<td></td>
<td>Simple flexor tendon cases</td>
<td>Mr Thomas Giesen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conference Room 2</td>
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<tr>
<td>10.20</td>
<td>Refreshment break</td>
<td>Pioneer Room</td>
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<tr>
<td></td>
<td>Flexor tendon/ serious hand injury cases</td>
<td>Miss Grainne Bourke</td>
</tr>
<tr>
<td></td>
<td>Secondary reconstruction cases after flexor injury</td>
<td>Mr Fortune Iwuagwu</td>
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<tr>
<td></td>
<td>Extensor tendon cases</td>
<td>Mr Vijay Bhalaik</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The Leader Suite (outside area)</td>
</tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.10</td>
<td>Lunch</td>
<td>Pioneer Room</td>
</tr>
<tr>
<td></td>
<td>Intrinsic: examination and understanding</td>
<td>Mr Donald Sammut</td>
</tr>
<tr>
<td></td>
<td>Tenolysis and skin problem cases</td>
<td>Dr Piotr Czarnecki</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adamson Suite (5th floor)</td>
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<tr>
<td>15.40</td>
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### Faculty

**International Faculty**

<table>
<thead>
<tr>
<th>Name</th>
<th>Title and Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr Piotr Czarnecki</td>
<td>Consultant hand surgeon, Medical University of Poznan, Poland</td>
</tr>
<tr>
<td>Mr Thomas Giesen</td>
<td>Consultant hand surgeon, Universitäts Spital, Zürich, Switzerland</td>
</tr>
<tr>
<td>Dr Caroline Leclercq</td>
<td>Consultant hand surgeon, Institut de la Main, Paris, France</td>
</tr>
<tr>
<td>Professor Jin Bo Tang</td>
<td>Professor of Hand Surgery, Nantong University, China</td>
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**National Faculty**

<table>
<thead>
<tr>
<th>Name</th>
<th>Title and Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr Vijay Bhalaik</td>
<td>Consultant hand surgeon, Arrowe Park Hospital</td>
</tr>
<tr>
<td>Miss Grainne Bourke</td>
<td>Consultant hand surgeon, Leeds General Infirmary</td>
</tr>
<tr>
<td>Miss Alexandra Hazelrigg</td>
<td>Hand Surgeon</td>
</tr>
<tr>
<td>Miss Catherine Hernon</td>
<td>Consultant hand surgeon, Leeds Teaching Hospitals</td>
</tr>
<tr>
<td>Mr Fortune Iwuagwu</td>
<td>Consultant hand surgeon, St Andrew’s, Chelmsford</td>
</tr>
<tr>
<td>Mr Anuj Mishra</td>
<td>Consultant hand surgeon, Manchester Hand Centre</td>
</tr>
<tr>
<td>Mr Zaf Naqui</td>
<td>Consultant hand surgeon, Manchester Hand Centre</td>
</tr>
<tr>
<td>Mr Simon Pickard</td>
<td>Consultant hand surgeon, RJAH Hospital, Oswestry</td>
</tr>
<tr>
<td>Mr Mark Pickford</td>
<td>Consultant hand surgeon, Queen Victoria Hospital, East Grinstead</td>
</tr>
<tr>
<td>Mrs Alison Roe</td>
<td>Hand therapist, University Hospital of South Manchester</td>
</tr>
<tr>
<td>Mr Donald Sammut</td>
<td>Consultant hand surgeon, Bath</td>
</tr>
<tr>
<td>Miss Gill Smith</td>
<td>Consultant hand surgeon, Great Ormond Street</td>
</tr>
<tr>
<td>Dr Krystyna Walton</td>
<td>Consultant physician in rehabilitation medicine</td>
</tr>
<tr>
<td>Miss Emily West</td>
<td>Consultant hand surgeon, Southmead Hospital, Bristol</td>
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### CME Points

Certificates of attendance will be emailed to delegates upon completion of the post event evaluation survey.

<table>
<thead>
<tr>
<th>Attendance date</th>
<th>Points awarded</th>
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<tr>
<td>Friday 2nd February 2018</td>
<td>7</td>
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<tr>
<td>Saturday 3rd February 2018</td>
<td>6</td>
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<tr>
<td>Whole meeting</td>
<td>13</td>
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</table>
I am a hand surgeon working in the Traumatology, Orthopaedics and Hand Surgery Department at Poznan University of Medical Sciences, Poland. I finished my training in orthopaedics and traumatology in 2011, the year before I passed European Examination in Hand Surgery during FESSH Congress in Bucharest.

Since the beginning of my medical career, I was bond to the department I work in. We cover most of the upper extremity problems including trauma, chronic diseases (degenerative arthritis, RA), post traumatic disorders (tendons, bony nonunions, nerves, coverage), congenital deformities and tumours.

I am a hand surgery consultant in several public and private hospitals and academic teacher at Poznan University of Medical Sciences. I am a member of the Polish Society for Surgery of the Hand (National Delegate, President Elect) and the Polish Society of Orthopaedics and Traumatology (Chief of Hand Surgery Section).

Abstract/s:

Tenolysis and skin problems

Limited active range of motion after tendon surgery (repair or reconstruction) can severely diminish hand function. If the tendon continuity is preserved, adhesions can produce tendon gliding deficiency.

If the clinical examination reveals relevant difference between passive and active range of motion tenolysis can be indicated to free the tendon or the graft from
adhesive bed thus enabling tendon gliding. Case history should be taken carefully in cases operated elsewhere and ultrasonography can help to assess tendon continuity.

Tenolysis needs meticulous technique and good anatomical knowledge. Tendon is separated from distal to proximal through several windows in the sheath, preserving crucial pulleys. Continuity and transmission is checked gradually. Problems with tendon identification have to be expected in cases when only one flexor tendon was sutured. This type of the surgery needs decision-making based on experience and local situation but improvement of function can be expected in about 60% of the cases.

Additional procedures can be employed including nerve reconstruction, pulley reconstruction, pulley venting, retensioning, lengthening or conversion to tendon reconstruction. In my opinion these procedures have to be decided carefully because they also can influence on worse result of the surgery.

After-treatment is based on active exercises started in 2nd day and needs qualified hand therapist and patient education. Complications in about 10% cases can be expected (tendon rupture, pulley rupture, tendon insufficiency, re-adhesions).

In cases of extensors tenolysis the main issue is zone I to IV of extensor apparatus. Due to complicated anatomy of this area flexion and extension problems can be expected and very often is hard to accomplish complete tenolysis in this region. Range of motion often needs to be improved by additional arthrolysis and capsuloligamentotomy of IP joints.

In some cases skin problems are accompanying tendon injuries. Usually these are flexion contractures with scars, that need to be released, Simple Z-plasties are of great value but in more severe cases pedicled flaps are also needed to cover the problem. In my experience skin problems usually accompany tendon discontinuity that is treated with staged surgery.

Several clinical cases are presented to discuss above issues.
Mr Thomas Giesen

Mr Giesen is a Hand and Orthopedic surgeon in Switzerland.

Since 2013 Mr Giesen has held a Consultant Hand Surgeon post in the Plastic and Hand Surgery Department of the University Hospital of Zurich, Switzerland. Previously he was a Consultant Hand Surgeon in the UK. During his training he was a Fellow in Microsurgery and Hand Surgery in Germany, India, England, USA and Italy. Mr Giesen has published numerous papers in International Hand Surgery journals and books, and since 2001 has regularly presented at National and International meetings with the results of his clinical research. In 2010 he was awarded the ‘Emanuel Kaplan Award for Anatomical Excellence’ in Boston, USA by the American Society for the Surgery of the Hand (ASSH) for the study: “The vascularization of the median nerve in the distal forearm and its clinical importance”.

His experience in Hand Surgery is at 360°, going from hand trauma “tout court” to the treatment of joint arthritis, tendon, ligaments and nerve pathologies, to more complex problem like extremities microsurgical reconstruction, brachial plexus palsy and hemiplegic spastic contractures.

Abstract/s:

Evidence in Flexor Tendon Injury Surgery

Immediate flexor tendon repair of the hand is common practice, however, routinely achieving a successful outcome from this treatment of flexor tendon lesions in zone 2 has remained an unsolved problem now for many decades. Immediate repair has traditionally suffered approximately 5% of ruptures and 5% of tendon adhesions, resulting in unsatisfactory function.

Various changes of management are being reported worldwide, seeking to reduce these problems and improve results. Both the surgery and the rehabilitation have been modified and refined in recent years, to try to achieve excellent results more regularly, while avoiding ruptures.
The central tenet of modern flexor tendon surgery is to increase tendon healing, and to avoid adhesion formation between the repaired tendon and the surrounding tissues by making a repair that is strong enough to move within a few days of injury, as first suggested nearly 100 years ago and pioneered in the modern era by Verdan and Kleinert.

The field where the results can be improved are: the suture technique, the suture material, the management of the tendon sheath, the chemical manipulation of the tendon, the rehabilitation protocol.

The main drive of the mechanical way forward in the last 20 years has been by modification of the suturing of the divided tendon, in particular the core suturing. A variety of materials have been used but no best suture material identified. Various core-suture techniques have also been described over the years. Through the 1990s and the early years of this century, the Tajima and Strickland variations of the (2-strand) Kessler suture, were probably the most commonly used core-suture technique in Europe, whereas the Tsuge suture or, more recently, Tang’s triple variation of it, were more likely to be used in the Far East.

As most of the published series of 2-strand core-suture zone 2 repairs in civilian populations from all over the world had roughly the same results, it would seem that most materials and most core-suture techniques in common use at that time worked equally well. Almost all had a rupture rate of between 2% and 9%, with an average of 5%. At the time, it was estimated that repairs needed to have a strength of 15 to 20 N to withstand early mobilization. However, in 1992 Schuind and colleagues measured forces of 120 N being transmitted through the flexor tendons at the wrist during strong pinch. In 1989, Savage and Risitano increased the core-suture strength substantially using a Kessler-type suture with 6 strands across the tendon ends. This approach stimulated a great deal of laboratory work and publication of a smaller number of clinical articles, which has continued unremittingly since that time, leaving us with a very confusing multitude of coresuture options and no clear “winner.” Savage’s suture has seldom been surpassed for strength, but is difficult to insert. For this reason it is widely avoided in clinical practice. Research since might be viewed with a cynical eye as attempting to devise a multistrand core-suture technique with the strength advantage of the Savage suture while being more practical for clinical use. The array of options is well documented in recent book chapters.

Although suture material does not seem to be of particular importance, Tang identified other factors of importance. Modification of the number of strands of the core suture, and the various ways of achieving this, has attracted most attention, whereas another option, namely use of a larger caliber of core suture, is discussed rarely, although appearing simpler, at least at first glance. The benefits of increased suture size have been shown fairly convincingly in the laboratory.
Lately the management of the pulleys has shown in literature a change in the classic philosophy that consider the A2 and A4 pulleys to be sacrosanct. However the literature is still scarce.

In 1975, Duran and Houser reported their protocol with controlled passive motion and stated that minimal tendon excursion was sufficient to prevent restrictive adhesions following tendon repair. In 1977, Lister and Kleinert reported encouraging results with immediate passive mobilization using an orthosis with rubber bands that allowed active digit extension and passive flexion resulting from recoil. These two protocols and their modifications dominated until the 1990s, when the idea of an immediate controlled active mobilization aroused.

After reviewing the literature, if we considered passive protocols the Kleinert and the Duran protocol, including all forms of place and hold and we considered active protocols all protocols where flexion and extension of the fingers are performed actively by the patient, it can be concluded that that the control active motion protocols seems to produce a significant higher rate of good and excellent results.

**Extensor tendon adhesions - tips and tricks**

Extensor tendon adhesion is a very common problem impairing hand function. It is the possible consequence to any trauma or infection to the hand, even in cases with a trauma or infection primarily affecting the palmar aspect of the hand. The swelling of the hand makes accumulate fibrin to the back of the digits, gluing the extensor tendon to the bone and/or to the skin. Clearly, any hardware placed on the back of the digits or any wound and extensor tendon lesion will add gluing tissue in the form of scar tissue.

As the fat paddle to the back of the hand is much less represented in comparison with the palmar aspect, extensor tendon adhesions are far more common in practice.

Nevertheless, this problem is underestimated in common practice and the literature is not as sharp as a young hand surgeon would desire, with mainly case reports. The surgical approach to extensor tendon adhesions should be performed after a long period of hand therapy and dynamic splinting, ideally after 6 months from the injury or the infection, when the scar tissue is not active anymore. A surgery in wide awake is helpful for the surgeon to judge an adequate release, but also passive intraoperative examining is extremely relevant. It should be clear to the surgeon that releasing the tendon where the adhesion looks clinically or sonographically obvious, might not be enough and a bigger exposure is often needed than anticipated.
It is a multilayer problem: the surgeon needs to be ready to release the contracted related joints and sometimes also to replace them. Equally important is to address the skin: a perfectly executed teno-arthrolysis might result in a disappointing function because of the concomitant lack of skin elasticity and/or lack of fat padding to the back of the hand. The hand surgeon should be aware of technical availability of different options available about skin incision, skin suturing, local flaps or distant flaps, to solve this soft tissue problem.

An aggressive hand therapy protocol is mandatory after surgery with immediate dynamic splinting, as well as a robust pain therapy. Avoiding placing hardware to the back of the hand might prevent some of the most common extensor tendon adhesions after uncomplicated fractures.

**Simple flexor tendon cases**

Two cases are presented of common flexor tendon lesions in Zone 2B, treated with a six strand core suture and no circumferential suture, A4 pulley division and partial FDS resection.
Dr Caroline Leclercq

Former President of the French Society for Surgery of the Hand.
Full member of the French Society for Surgery of the Hand (GEM)
Honorary member of the British Society (BSSH) and the Australian Society for Surgery of the Hand
Member of the American (ASSH), Hellenic, and Colombian Societies for Surgery of the Hand
Member of the French “Académie de Chirurgie”

Dr Caroline Leclercq studied medicine in Paris, France, and specialized in hand surgery under the guidance of Professor Raoul Tubiana and Professor Alain Gilbert. Following a travelling fellowship in the United States, she joined the Institut de la Main in Paris.
She has developed experience in the treatment of sequella of paralyses of the upper limb, especially in the fields of tetraplegia and spasticity, and is a consultant in 8 neurological rehabilitation centres (both adult and children).
She is the author and co-author of 7 books and more than 100 scientific articles and book chapters, and has presented more than 60 oral presentations at National and International Society Meetings. She is heavily involved in teaching, both nationally and internationally.
Her main fields of interest, besides paralytic and spastic upper limb, are Dupuytren’s disease, sports injuries, and hand tumors.

Principles of management of spasticity

C. Leclercq
Institut de la Main, Paris, France
www.spastic-hand.com
Spasticity is characterized by muscle hypertonia, caused by a hyperactive stretch reflex mechanism. It is linked to a central neurological impairment involving the pyramidal tract.

It may occur in several circumstances:
- in children, *cerebral palsy* is usually secondary to foetal or perinatal encephalopathy,
- in adults, *stroke or head injury*
- *tetraplegia* is often associated with spasticity of the lower limbs. Spastic involvement of the upper limbs is rare, usually associated with incomplete tetraplegia.

Spasticity is rarely an isolated feature. The clinical picture generally includes other neurological and orthopaedic impairments which need to be carefully assessed together with the spasticity.

The clinical picture may vary greatly from one individual patient to the other, depending on the amount and location of the initial brain insult.

Clinical examination is a critical part of the assessment. Its goal is fourfold:

- Evaluate spasticity.
- Evaluate possible muscle contracture and joint deformity
- Evaluate motor and sensory impairment in the upper limb.
- Evaluate existing function, and functional needs of the upper limb.

Other neurological and orthopaedic impairments are frequently associated, and need to be carefully assessed.

Surgery has a limited place in the treatment of spasticity of the upper limb. It is only one element of the rehabilitative care, which includes primarily physiotherapy and splinting, occupational therapy, and pharmacological treatment as needed.

The goals of surgical treatment depend on the extent of the initial cerebral lesion. Whenever possible, it is to improve function. In some cases, however, it will be limited to improving nursing and comfort, or to correct a severe deformity.

Three types of procedures may be indicated, in isolation or together:

1. Those which aim at reducing spasticity
2. Those which aim at reducing muscle and/or joint contracture
3. Those which aim at reinforcing paralysed muscles

In any case, the surgery will have to address all the deforming causes, in order to rebalance the forces exerted around the involved joint.
Jin Bo Tang, MD


Professor and chair, Department of Hand Surgery, Affiliated Hospital of Nantong University, Chair, The Hand Surgery Research Center, Nantong University, Jiangsu, China

Dr Tang has practiced hand surgery after his graduation from Nantong Medical College in 1985 and completion of clinical training in early 1990s. He has published 170 peer-reviewed papers in English and 30 commentaries, editorials and essays, 40 book chapters, and edited 6 books.

The major work of Dr Tang is on flexor tendon repairs, soft tissue injury, and biomechanics of tendons and carpus. He also directs a laboratory working in the frontier of basic science of biological tendon repairs. His work has greatly changed clinical practice of flexor tendon repairs. He developed classification of zone 2, several multi-strand tendon repair (including currently popularly used M-Tang repair), pulley-venting techniques, zone 1 flexor tendon repairs, and functional evaluation after tendon repair. He is considered one of most active hand surgeon internationally. He has also contributed to worldwide advancement of this profession through lectures in various countries, publications, journal editing, and organization of educational courses.

Abstract/s:

Principles of flexor tendon repair including choice of suture, number of strands and epitendinous, configuration of strands

For primary repair of the flexor tendons in zone 1 and 2, at least a 4-strand core suture should be used. A 6-strand core suture is ideal. Simple running peripheral
sutures are usually sufficient. Some surgeons use only sparsely placed simple running peripheral sutures, or without adding the peripheral sutures after a 6-strand core suture. 3-0 or 4-0 non-absorbable sutures are used. Fiberwire is strong, but rigid, which is best not used in repair in the digital sheath area. Configurations of the repairs are largely decided by preference of individual surgeons. Any repair methods should ensure following principles of repair: (1) sufficient core suture purchase of 0.7-10 cm in each end of the tendon, (2) maintaining proper tension of the core suture, to prevent loose tendon repair junction and gapping, and (3) ensuring large enough (2 mm) locks in tendon tissues if locking sutures are used. I used a 6-strand repair using 2 groups of looped nylon sutures, which has been used in my units and many other units, the rupture rate is very low. Three units where our method is used had only 1 repair rupture out of 300 repairs in 4 years. I favor a strong direct reinforced repair of the proximal tendon to terminal stump of the profundus tendon in terminal zone 1 repair. I no longer use pull-out repair. For zone 3 to 5 repairs, I used 4- or 6-strand repairs in zone 3, 4-strand repairs in zone 4 to 5. Early active motion is always used after these repair.

Management of pulleys when to vent, management of tendons in zone 2 when to strip tendon

Most annular pulleys in the fingers should be preserved during primary or delayed primary repair, but some of the key pulleys can be vented to allow free gliding of the repaired tendon. I vent the A2 pulley when the repair is at or 1 to 1.5 cm distal to the A2 pulley. I vent the A2 pulley to half or 2/3 of its length (its length in the long finger is about 1.5 to 2 cm in adults). I vent the entire A4 pulley if the repair is in the middle of the middle phalange. A longitudinal mid-line incision is an easy way of venting. The venting can also be at the lateral side of these pulleys. A3 pulley can be vented together with the A4 pulley if necessary, but the synovial sheath proximal to the A3 pulley should be kept intact if the A4 pulley is vented. The total length of sheath and pulley venting should not exceed 2 cm, to prevent tendon bowstringing. I do not repair the FDS tendon in most cases, and do not recommend FDS tendon repair in zone 2C or in delayed primary repair, as the edematous FDP will be hard to glide in delayed primary repair or in zone 2C (where the gliding space is very narrow). In thumb flexor tendon repair, the oblique pulley often need venting to access the tendon and allow free motion of the FPL tendon. In repairing flexor tendons in zone 2 in the fingers and thumbs, intra-operative flexion-extension test of the repaired finger is very important to ascertain that the repair is secure without gapping and the pulleys are sufficiently vented. I recommend all the repairs in zone 2 should pass this test before skin closure. The repair in wide-awake setting would allow active tendon motion in the operating table; therefore, this test will be more accurate.
Flexor ten don injuries are common. The successful outcome of surgical repair depends on meticulous surgical repair and early rehabilitation. A non-absorbable 3.0 or 4.0 braided or monofilament stitch is used for the core suture and this is combined with a 6.0 epitendinous suture. The key factors in determining the strength of repair at the time of surgery are the grip of the suture in the tendon and the direction and curvature of the path of the tendon motion. Gripping of the core suture to the tendon prevents suture failure. The strength of the repair can be increased by increasing the number of core strands across the repair site. A balance between the number of strands of the core suture and the vascularity of the tendon has to be achieved for a successful outcome. An epitendinous suture improves gliding of the tendon across the pulleys and also provides strength to the repair.

Further reading:
Langley C, Hobby J. Focus on Flexor Tendon Repair. JBJS(Br).
Miss Grainne Bourke

Grainne Bourke is a consultant in plastic reconstructive and hand surgery in Leeds Teaching Hospitals Trust. She is a specialist in children’s hand surgery, microsurgery and nerve injury in children and adults. She is an Honorary Clinical Associate Professor at the University of Leeds with research interests in nerve injury, repair and imaging. She is enjoying being part of the committee for the BSSH Instructional Courses in Hand Surgery.

Abstract/s:
Swan neck Deformity

Swan neck deformity is a finger deformity characterised by hyperextension of the proximal interphalangeal joint combined with flexion of the distal interphalangeal joint. It is thought to resemble a swan’s neck. This can be physiological or pathological.

Physiological Swan neck deformity is seen in children and teenagers with general joint laxity and increased mobility. It is actively and passively correctable and in general requires no treatment.

In pathological swan neck deformity laxity of the volar plate of the PIP joint permitting hyperextension of this joint. The DIP joint flexion is a result of rupture or attenuation of the distal extensor tendon with dorsal displacement of the lateral extensors resulting in hyperextension of the PIP joint.

Pathological Swan neck Deformity arises from laxity of the volar structures of the PIP joint and is combined with DIP joint flexion deformity. It is most commonly seen in Rheumatoid arthritis, Spasticity disorders, trauma, intrinsic imbalance, mallet
deformity in patients with laxity of the PIP joint and iatrogenic causes for example distal harvest of the FDS tendon for transfer in patients with PIP volar plate laxity. **Treatment options include non operative and operative strategies.** Non operative is largely based on splints including ring, oval eight and static splints. Maintaining joint mobility and range of motion is critical for both non operative and operative management.

Successful operative options rely on recreating the oblique retinacular ligament construct that strengthens the PIP volarly restricting hyperextension of this joint but allowing active extension of the DIP joint. The most commonly used techniques include Littler’s oblique retinacular ligament reconstruction using a lateral band. The Spiral Oblique Retinacular ligament reconstruction utilises a tendon graft to act as a dynamic tenodesis. Other options using FDS slips for PIP extension restraint have also been described.

**References:**

Thompson JS, Littler JW, Upton J.

Wei DH1, Terrono AL2

Nalebuff EA1.
Dean Boyce is Consultant and Clinical Lead of the Welsh Centre for Plastic Surgery and Burns. He was appointed in 2003 after training in South Wales, the West Midlands, Manchester, Wrightington, and Sydney, Australia. He has a strong academic background, having been awarded a Hunterian Professorship for research into human and scar less wound healing. His current research areas mirror his clinical interests in peripheral nerve surgery, congenital hand surgery, upper limb cerebral palsy and Dupuytren’s disease. He is heavily involved in postgraduate training and is currently selection lead for the national ATP fellowships in hand surgery. He is a Council Member of the British Society for Surgery of the Hand and Vice Chair of Education for the British Society of Plastic, Reconstructive and Aesthetic Surgeons.
Miss Alexandra Hazlerigg

Alex Hazlerigg is a ST8 on the Trauma and Orthopaedic rotation in the Oxford Deanery. She is currently based at Royal Berkshire Hospital, Reading. Her undergraduate degree was at Imperial College, London, and she has completed a BSc in Advanced topics in biomedicine, and a postgraduate diploma in Trauma. She was awarded her FRCS (Tr&Orth) in 2016. She is passionate about teaching and training and last year was the Senior Representative for Oxford Orthopaedic Trainees Association, organising the annual Orthopaedic Academic Conference, also known as Duthie Day. She was a member of the BSSH committee as the BOTA representative 2014–2017, and prior to this was on the BOTA committee 2011–2014. She is Educational Supervisor to several Oxford Medical Students and has been awarded three times the ‘above and beyond the call of duty’ nomination for teaching. She is an ATLS instructor, and has previously taught as an anatomy demonstrator at Charing Cross Hospital, London.

Abstract/s:
**PATHOANATOMY**
- Discontinuity of the terminal extensor tendon
- Migration of the extensor apparatus proximally
- Increased extensor tone at PIP relative to DIP
- Hyperextension of PIP: Swan neck deformity
- Fracture of the distal phalanx may lead to volar subluxation
- Neglected injuries—permanent stiffness and deformity

**DOYLE CLASSIFICATION**

<table>
<thead>
<tr>
<th>Type</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Closed injury</td>
</tr>
<tr>
<td>II</td>
<td>Associated with overlying skin laceration</td>
</tr>
<tr>
<td>III</td>
<td>Associated with tendon and loss of overlying skin (deep abrasion)</td>
</tr>
<tr>
<td>IVA</td>
<td>Transphyseal injury in skeletally immature digit</td>
</tr>
<tr>
<td>IVB</td>
<td>Associated with avulsion fracture involving 20-50% of articular surface</td>
</tr>
<tr>
<td>IVC</td>
<td>Associated with avulsion fracture involving &gt;50% of articular surface</td>
</tr>
</tbody>
</table>

**OUTCOMES**
- **Definition of a satisfactory outcome** (Geymon et al.):
  - DIP: exhibits a residual lag <20 deg
  - DIP flexion arc is >50 deg
  - Patient reports minimal or no pain
  - Want to avoid Swan neck deformity
    - Overpowering of the lateral band

**SOFT TISSUE MALLET-TYPE I**
- **Rupture of extensor tendon zone I**
  - Splint for 6 weeks
  - Night time splinting for 6 weeks
  - Discharge from clinic with spare splints advice about skin care
  - Warn patients of residual lag
  - Pain and swelling may take 6 months to settle

**OPEN MALLET FINGER**
- **Requires operative repair**
  - Mass vs separate repair
  - K wire to stabilise the repair while tendon heals
  - If tendons ends are damaged a turnover of one lateral band can be used to strengthen the repair (chronic and acute injuries)

**MALLET FRACTURE (TYPE IV)**
- Bony mallet: small fragment of bone attached to the tendon
- True lateral radiograph of the injured digit
- Size and displacement
- Volar subluxation of the distal phalanx

**MALLET FRACTURE (TYPE IV)**

- Associated with avulsion fractures involving 20-50% of articular surface
- Associated with avulsion fracture involving >50% of articular surface
**NON OPERATIVE-SPLINTING CONTROVERSIES**

- **Duration**
  - About 30% of closed injuries heal with 6-8 weeks of splintage with a further period of being worn at night. Requires compliance.
  - Further splintage beyond this treatment time can be successful.

- **Style**

**OPERATIVE MANAGEMENT**

- **K wire fixation**
  - Acceptable across DIP, stiffness is well tolerated
  - Use of double tipped K wires can avoid hindering PIP motion (Combined with arthroscopic technique)

- **Screw fixation**
  - Supplementary K wire blocking may be necessary to aid reduction
  - Warn patients dorsal prominence may still persist

**K WIRE FIXATION**

- Transarticular pinning of DIP +/- fracture fragment fixation
  - A. Tension band constructs
  - B. Compression pinning
  - C. Extension block pinning
    - (Taele and associates)
    - (Jung)

**CHRONIC MALLET FINGER INJURIES MANAGEMENT OPTIONS**

- **Non-Operative**
- **Operative**
  - Fowler’s central slip tenotomy-delay by 3 months (Heuguet et al. 1999)
  - Tenodesis
  - Spiral Oblique retinacular ligament reconstruction
  - Terminal extensor tendon shortening

**CHRONIC MALLET FINGER INJURIES**

- **NON-OPERATIVE MANAGEMENT**
  - **Splint**
    - Bresettenski and Schneider
    - No difference between patients splinted early (<2 weeks) and late (>4 weeks)
      - (Garberman et al.)
    - Continuous extension splinting (10 weeks)
      - (Patel et al.)

- **OPERATIVE MANAGEMENT**
  - Fowler’s Central Slip Tenotomy (1949)
CHRONIC MALLET FINGER INJURIES
OPERATIVE MANAGEMENT

- Tenodesis (Iselin 1977)
  - + K wire

- Spiral Oblique retinacular ligament reconstruction

SEYMOUR FRACTURES

- Failure to recognize injury
  - Nail plate deformity
  - Physical arrest
  - Chronic osteomyelitis
  - Flexion deformity

TAKE HOME MESSAGES

- Mostly non-operative
- Warn patient about a residual lag
- Pain and swelling may take 6 months to settle
- True lateral x-ray in splint for bony malts

REFERENCES

Mr Fortune C. Iwuagwu

Mr Iwuagwu trained in many of the internationally recognised plastic surgery units in the country before spending over a year at the Christine Kleinert Institute for Hand and Microsurgery. On return from the United States, he was appointed to the post of Consultant Plastic, Reconstructive and Hand Surgeon at the St Andrews Centre for Plastic Surgery and Burns, Broomfield Hospital, Chelmsford and the Whipps Cross University Hospital, London, a position he has held from 2003 till date.

His research interest are in the areas of the early cellular response in tendon healing and modification of the acute inflammatory response following hand surgery. He subspecialty interests include post trauma soft tissue reconstruction and microsurgical reconstruction of the hands both for trauma and elective pathologies. He also has a microsurgical breast reconstruction and general plastic surgery practice.

Abstract/s:

Secondary flexor tendon reconstruction

• This is a case based discussion. Scenario (s) will be presented and used for discussion.
• For e.g.
• A 40 year old man was involved in a ghastly motor accident during, which he suffered a brain injury and was found unconscious by the paramedics. He spent weeks in the ITU. Following this he started physiotherapy and made a remarkable recovery. Three months later he saw his GP because he could not bend his middle finger.
The learning objectives are:

- Indications
- Diagnosis
  - Clinical
  - Look for donor graft
  - Investigations
- Choice of single or two stage reconstruction
- Timing
- Preoperative management
  - Hand therapy
  - Management of soft tissues
- Intra-operative
  - Adhesions
  - Pulley management
  - Choice of tendon graft
  - Fixation of tendon graft
  - FDS management
- Miscellaneous situations
  - No pulleys, FDS sacrifice, FDP left in place
  - FDP turnover lengthening
  - Musculo-cutaneous junction lengthening
Mr Anuj Mishra

Mr Mishra is a Consultant Plastic, Reconstructive, Hand and Peripheral Nerve Surgeon. He studied at medical school in Delhi University and went on to complete his Masters in Surgery and Plastic Surgery. After his initial training in the prestigious plastic surgery units in Chelmsford and Swansea, he was appointed to the Mersey Plastic Surgery Registrar Training scheme where he underwent six years of plastic surgery training and was involved in clinical research with over 100 research paper presentations and publications.

After completing his hand fellowship in Liverpool, he was then appointed to Advanced Training hand fellowship in Birmingham where he successfully undertook his British and European Hand Diploma exams in 2013. He then went on to develop his specialist interest in peripheral nerve surgery and refine his skills in major trauma management and microsurgical reconstruction.

Mr Mishra was awarded the Douglas Murray Travelling award to travel to Bangkok to expand on his brachial plexus and peripheral nerve interest. He was also awarded FESSH travelling award to travel to Paris to further develop his interest in hand and peripheral nerve interest before commencing his Consultant job at the University Hospital of South Manchester in 2014. He currently divides his time working at Wythenshawe Hospital, Salford Royal Infirmary, and Trafford General Hospital within the NHS. He is a founding member of the Manchester Hand Centre, which has the goal of centralising and driving excellence in NHS hand surgery across Manchester.

Mr Mishra is passionate about teaching and training and actively teaches higher surgical trainees as a matter of course, and has presented more than 150 papers both nationally and internationally. He has published more than 50 peer reviewed articles and has contributed to book chapters, and is involved in the assessment of higher surgical trainees nationally. He has been part of the first two Masters in hand surgery. He was awarded the certificate of excellence in education by the North West School of Surgery in 2015.
Mr Mishra’s areas of particular interest are complex and microsurgical limb reconstruction, brachial plexus and peripheral nerve surgery, and he undertakes this alongside managing all common hand conditions including trauma and emergencies.
Mr Lindsay Muir is a consultant hand surgeon at Salford Royal. He is chairman of the ICHS and co chairman of the European Board of Hand Surgery Diploma Exam.
Mr Zaf Naqui

Zaf Naqui is a Consultant Hand and Wrist Surgeon at the Manchester Hand Centre, Salford Royal Hospital. He is an Honorary Senior Lecturer at the University of Manchester and chair of the North West Surgical Hand Society.

He was awarded dual postgraduate certification in Hand Surgery from both the British and the European Boards of Hand Surgery in 2013. He was awarded the BSSH Stack Fellowship and ASSH International Travelling Fellowship in 2014. In 2016 he was awarded the first ever ‘MSc in Hand Surgery’ from the BSSH and University of Manchester for his research in to the management of chronic scapholunate dissociation.

He is an examiner for both the British and the European Board Hand Diploma and a committee member for the ‘BSSH Instructional courses in Hand Surgery’. He is the founder and convenor for the ‘BSSH Masterclasses in Hand Surgery’.

He is the social media editor for the Journal of Hand Surgery(E) and social media chair for the BSSH and FESSH. He is currently serving as council member for both BSSH and FESSH (2018-2020).

Abstract/s:

Principles of Amputations Distal to the CMCJ

Mr Zaf Naqui, The Manchester Hand Centre, Salford Royal FT
zafnaqui@gmail.com, T: @zafnaqui

A carefully planned amputation is in many circumstances the best form of reconstruction. In this talk, we will cover the principles of digital amputation.
Goals of surgery are to (i) preserve functional length, (ii) have durable coverage, (iii) preserve sensibility, (iv) in a short period of time. In addition, you must try and avoid (v) symptomatic neuroma and (vi) joint contractures.

Distal phalynx: There are many techniques to cover the tip, many not without complication. Healing by secondary intention, if possible, appears to be least problematic.

DIPJ to MCPJ: The insertion points and viability of the flexor tendons play a key role in determining what level of amputation works best. Complications such as the quadriga phenomena and lumbrical plus finger need to be mitigated.

Ray Amputation: This is best done as a secondary elective procedure. A narrow palm with reduced grip strength needs to be weighed up against high satisfaction rates with cosmesis and function. Transposition of the adjacent ray is an option when amputating the central rays, the alternative with fewer complications is to close the space by suturing the intervolar plate ligaments. Amputation of the 5th ray needs to preserve the metacarpal base due to insertions of the ECU and FCU.

Multiple Digits: It is important to be as conservative as possible, preserving soft tissue which may be useful for later reconstruction.

Thumb: The key functional attributes of a thumb, namely (i) sensibility and (ii) opposition need to be considered when planning amputation. Sensibility may necessitate an innervated flap. Good opposition requires stability, strength, length and mobility. Amputation at the IPJ and distal may not require reconstruction, the stump having adequate length. Proximal to this there are many reconstructive options depending on length, viable innervated skin and the patients functional needs.
**Present Appointment:**

Consultant Orthopaedic Surgeon

Robert Jones and Agnes Hunt Orthopaedic Hospital and

Royal Shrewsbury Hospital

General orthopaedic trauma and elective hand surgery with an interest in reconstructive surgery following neurological injury.

My current appointment includes providing General orthopaedic trauma care at the Royal Shrewsbury Hospital on a one in nine basis and both trauma and elective upper limb surgery at the Robert Jones and Agnes Hunt Orthopaedic Hospital (RJAH).

My elective practice includes routine hand surgery and reconstructive surgery for paralysis (peripheral nerve injury, spinal cord injury and brain injury including cerebral palsy).

At RJAH I am part of a team providing a consultant led tertiary referral service for hand and wrist injuries as well as complex upper limb fractures.

My fields of interest within this are:

**Brachial plexus and Peripheral Nerve Injury**

My college (Mr D Ford) and I run the RJAH peripheral nerve injury service. We are part of the North West Midlands trauma network, providing treatment of patients referred from across the region. A monthly multidisciplinary clinic is held at RJAH and a regular outreach clinic at Royal Stoke Hospital.
Surgery for Traumatic Brain Injury and Cerebral Palsy
I am part of a multidisciplinary team providing upper limb reconstruction and treatment for the consequences of cerebral palsy and acquired brain injury. We hold a monthly multidisciplinary clinic in ORLAU.

Spinal injuries
As part of the West Midlands Spinal Injuries Center (Oswestry) and the North West Spinal Injuries Center (Southport) I provide acute care for upper limb injuries and reconstructive upper limb surgery for tetraplegic patients covering a population of 16 million. I am part of monthly MDT clinics at both RJAH and Southport as well as regular research clinics in ORLAU looking at bioengineering solutions.

I have been part of an expert multidisciplinary panel writing guidelines for the management of tetraplegic patients under the auspices of the UK Spinal Cord Injury Research Network (UKSCIRN).

I am currently chair of ‘Tetra Hand UK’, a special interest group of rehabilitation physicians, surgeons, therapists and bioengineers looking at restoring upper limb function to tetraplegic patients.
Mark Pickford has been a Consultant Plastic and Hand Surgeon at the Queen Victoria Hospital, East Grinstead, West Sussex since 1997. His interests include the management of congenital hand abnormalities, hand trauma and wrist pathology.

Handouts:

**Extensor tendon injuries: management of the Central Slip and Boutonnière**

Kleinert and Verdan described 7 extensor tendon zones, to which an 8th has subsequently been added [the muscles themselves]. The central slip lies in Zone 3 along with the lateral bands, the Transverse Retinacular Ligaments and part of the Triangular Ligament.

The central slip is largely formed from the extrinsic extensor tendon but receives a significant contribution from the lateral bands, which, in turn, also receive fibers from the extrinsic extensor shortly before insertion into the P2 base. The central slip inserts into the dorsal lip of P2; on its deep surface is a substantial fibro-cartilaginous plate, the Dorsal Plate of the PIPJ, analogous to the volar/palmar plate. Its significance is in allowing robust tenorrhaphy even within a few millimeters of the point of insertion.

The Transverse Retinacular Ligaments pass from the sides of the lateral bands to the sides of the flexor sheath at the same level; they limit dorsal migration of the lateral bands in extension.

The Oblique Retinacular Ligaments pass underneath the Transverse Retinacular ligaments between the side of the conjoined extensor at the distal P2 level and a proximal attachment to P1 where the distal part of A2 arises. The Oblique Retinacular Ligaments effect passive extension of the DIPJ when the PIPJ is extended, whether actively or passively.
The triangular ligament lies between the lateral bands in the proximal part of P2 and exists to prevent palmar migration of the lateral bands; incompetence of this ligament is a prerequisite for the development of a Boutonnière deformity.

Acute injuries may be open or closed and may be associated with fracture. Fractures are managed according to the size of fragments and displacement of those fragments. Large dorsal fragments that are displaced should be reduced and fixed.

Acute injuries do not present with Boutonnière deformity, rather they present with loss of, or weakness of, PIPJ extension. Cases of so-called pseudo-Boutonnière do not present early and are typically due to PIPJ contracture after closed volar plate injury.

Clinical assessment of the central slip has been reported using numerous tests:

1. Tenodesis testing – the wrist is fully flexed and also the MCPJ’s which maximally tighten the central slip. The degree of tightening lessens toward the ulnar border of the hand but in an uninjured digit the PIPJ should fully extend.
2. Carducci’s test – the wrist and MCPJ’s are flexed then the patient is asked to actively extend the PIPJ
3. Ellson’s test – the PIPJ is help in flexion whilst the patient attempts to actively extend that joint. If the central slip is intact the lateral bands remain relaxed and the DIPJ remains floppy. If the central slip is divided or avulsed, tension is increased in the lateral bands during the maneuver due to proximal migration of the extensor at the P1 level, causing the DIPJ to become extended and resistant to passive flexion.
4. Boye’s test examines the ability to passively flex the DIPJ when the PIPJ is held in extension; tight lateral bands in cases of central slip injury create a stiffness and lack of passive DIPJ flexion. I don’t think this test has any advantages over the others reported above.

All of these tests may be affected in cases of established Boutonnière that are complicated by secondary joint contracture.

In closed Central slip avulsion the treatment is always splintage, which should allow the DIPJ to flex, for the added benefit of relieving tension on the central slip. Splintage should continue for 8 weeks and can be used in late presenting cases, which remain correctable/supple.

In open division of the central slip repair should be carried out with a locking core suture and running stitch along the margin (Doyle); I personally add a Silverskiold
suture for extra security. Protected mobilization is required thereafter for 8-10 weeks (SAM regime).

In open injury with loss of substance the central slip can be reconstructed using a number of techniques including the use of a single distally based strip of FDS passed through to the dorsum via a 3mm drill hole through base of P2. Enough tendon can be provided to weave the tendon over the dorsum of P1 if the FDS slip is tenotomised in the distal palm.
In cases with established Boutonnière reconstruction should not be preformed until the digit is capable of full passive extension, which may require preliminary surgery to release the PIPJ, for example by releasing the check rein ligaments and the accessory collateral ligaments of the PIPJ.

Surgery involves rebalancing the PIPJ and also the DIPJ, which may be the more troublesome of the affected joints. To allow DIPJ flexion a Dolphin tenotomy is performed in which the conjoined tendon is divided at the distal P2 level, preserving the ORL’s. If the Lag to extension at the PIPJ is also improved by the Dolphin tenotomy then no further treatment is indicated. If there remains a significant PIPJ extension lag then one of the established techniques of central slip reconstruction can be used, such as the use of a distally based FDS slip.
A classic technique for surgical treatment of Boutonnière is the Matev procedure in which both lateral bands are divided at the P2 level, one longer one shorter; the longer LB is transferred to the remaining other LB distally to provide DIPJ extension and the shorter LB is attached to the base of P2 in the central slip insertion area to provide a motor for extension at that level. In my opinion this is a clever concept but it is probably over complicated.

**Flexor tendons: Tip and Tricks including spaghetti wrist and how to manage Campers Chiasma**

1. Incisions: Incisions must allow good access and easy extension; they must also avoid any risk of scar contracture and should minimise the risk of flap tip necrosis. Delayed wound healing can interfere significantly with rehabilitation, partly through the need to manage healing delays with dressings. Mid-lateral and Brunner type wound extensions are standard but should be planned with care to avoid narrow flaps (<90 degrees).

2. Tendon retrieval techniques are well described and include so-called ‘milking’, careful retrieval with a fine haemostat and a technique described by McGrowther, which uses a fine paediatric feeding tube or other fine plastic tube such as an epidural catheter. The tube/catheter is passed from the palm at the A1 level distally until it emerges from the flexor sheath; a suture is passed through the side of FDP in the palm and fixed to the catheter. Traction then draws the tendon distally. I personally prefer the use of interosseous wire loops which can be guided though
narrow canals with ease; I use a wire loop to ‘catch’ sutures which have already been passed through the divided tendon end(s) for retrieval. Wire loops are a versatile tool in hand surgery and have multiple roles including splitting FCR for LRTI and Brunelli procedures and for passing tendon strips through bone.

Passing FDP under A4, the tightest digital pulley, can be extremely challenging and is an indication for some surgeons to consider ‘venting’ A4, something I prefer to avoid. Passage of the tendon is made easy by passing a core suture and also a ‘leading edge’ suture to allow the FDP to be pulled by its tip. The latter is discarded once the tendon has been successfully advanced.

3. Novices to flexor tenorrhaphy of often struggle to repair divided flexors with the injured digits held in flexion i.e. the position of injury, in order to deliver the distal FDP for repair. Callan and Morrison described an ingenious technique in which flexor tenorrhaphy is performed with the digits in neutral extension i.e. a helpful position for the performance of surgical repair. The technique relies on the knowledge that the end of the retracted FDP stump can be pulled beyond the level of the original tendon laceration due to the flexibility/stretch of the musculo-tendinous unit, which is capable of allowing marked MCPJ hyperextension i.e. there is extra available excursion. [Callan and Morrison JHS 1994]

4. Graft sources for flexor tendon reconstruction include PL, Plantaris and extrinsic toe extensors. In cases where both the FDP and the FDS have been injured, and the FDP is being reconstructed, FDS can be used as the graft [Paneva-Holevich]. At the time of tendon rod insertion a tenorrhaphy between FDS and FDP is performed in the palm just proximal to A1/ just distal the lumbrical origin. At the time of rod removal the FDS tendon to the same digit is tenotomised at its musculo-tendinous junction. Flexor tenolysis must be performed to ensure satisfactory excursion and the healed tenorrhaphy is ‘freed up’ to allow the FDS to be passed to the distal part of the digit for anchorage.

5. Standard teaching is that in 2-stage tendon grafting the graft is fixed distally first, using any one of a number of well recognised techniques, then the proximal tenorrhaphy is performed in the palm or wrist using a weave technique and setting the tension at that point in the procedure. I personally perform the palmar weave first, then deliver the graft to the distal digital wound and onwards through the pulp, close to bone, finally delivering the graft through a short hyponychial incision before setting tension with a temporary suture through the skin. I use several 3.0 Prolene sutures to fix the tendon to the nail plate. The graft that is exposed at the fingertip rapidly desiccates but retains its strength and should not be interfered with! It spontaneously separates from the skin at the level of the hyponychial incision after 6-8 weeks, at which stage the nail sutures are removed.
6. Pulley reconstruction is carried out when there is a perceived risk of bowstringing, the effect of which is a loss of active flexion. For A2 reconstruction PL graft can be wrapped around P1 2-3 times suturing the graft to itself and passing the graft underneath the extensor hood in order not to interfere with the function of the latter. If sufficient A2 remnant remains PL can be woven through the so-called ‘Always present rim’. For A4 PL graft can be used to create a loop around the P2, passing over the extensor. A single FDS slip can be used to create an oblique pulley by crossing the midline of the digit and fixing it to the opposite side of the A2 pulley; an FDS slip can also be fixed to the opposite side of the same phalanx to create a reconstruct A4.

7. In cases where there is difficulty performing a tenorrhaphy that is capable of gliding under A4 [distal Zone 1 injuries] Elliott described a technique in which the FDP is split into two halves, one of which is resected, to create a less bulky tendon that can pass easily; it was shown that the cross sectional area of an FDP ‘demi-tendon’ is greater than the cross sectional area of PL, the most commonly used graft. There is no reason why less than 50% of the tendon cannot be trimmed to effect a suitable de-bulking that allows free gliding.

8. Campers Chiasma is the part of FDS where fibres decussate across the midline of the digit after the FDS slips have passed around the sides of the FDP tendon and then come together behind the latter. This area is tricky for tenorrhaphy because the individual FDS slips are insubstantial but the standard goal is to repair each slip independently using a locking core suture if possible. Very close to insertion it may only be possible to use a mattress suture in the distal stump. If repair of both FDS slips and FDP creates too much bulk to allow smooth gliding under A2 it is perfectly acceptable to apply the demi-tendon principle by resecting one FDS slip back to the A1 level.

9. Spaghetti wrist; although some authors apply strict criteria to define spaghetti wrist for most of us this term simply refers to cases in which multiple structures are divided between the M-T junctions in the distal forearm and the carpal tunnel. These can be extremely lengthy procedures! The number one problem to avoid is joining up the wrong digital flexors, which is achieved by safely extending the wound then debriding synovium to allow all tendons that are in need of repair to be clearly identified. The latter should be tagged/ marked and repair should start with deeper structures; FDP then FDS, followed by wrist flexors and finally neurovascular structures.

10. In late presenting flexor tendon injuries (4-weeks plus) grafting is sometimes the only option. In some cases the tendon[s] can be repaired but are too tightly within cascade to expect a favourable outcome. Lengthening the musculo-tendinous unit by the Le Viet technique can allow sufficient length to be gained to manage the tensioning issues and therefore avoid grafting. The technique involves complete
division of the tendon WITHIN the musculo-tendinous region so that the muscle fibres maintain continuity and therefore function; up to 2 releases can be performed by carefully selecting the points of tendon division.
Ms Alison Roe

I have worked in the field of Burns and Plastic Surgery for over 30 years, initially specialising in burns care and thereafter in Hand Therapy.

I spent a number of years at Keele University, where I was Head of Clinical Education on the BSc (Hons) Physiotherapy programme.

My research interest is in Flexor tendon Injury and subsequent rehabilitation. I have been a co author on a number of publications on this topic area and have presented both nationally and internationally.

I was one of the pioneers of the Manchester Short Splint and I am currently involved in an RCT regarding this.

I am a member of BAHT and have recently been part of a therapy working party who devised and published UK Standards of Care for the Rehabilitation of Flexor Tendon Injuries, under the auspices of the BSSH subcommittee for standards.

Abstract/s:

Rehabilitation of flexor tendon injury including physiology

Despite the quest to find the optimal therapy regimen, there is still no evidence for best practice and no globally accepted programme and as such practice remains diverse worldwide.

Numerous therapy regimens have been favoured over the last century and following the advent of the robust multi strand repair, controlled active mobilisation (CAM ) is now the primary regimen of choice in the UK with an educated, compliant patient.
This talk will present the Manchester experience and regimen, including the change in practice we implemented i.e. the introduction of the Manchester Short Splint (MSS). The results following an audit comparing the traditional versus the short splint will be discussed and an update given on the advice to patients for ‘Safe Function’ following surgery.

The management of children will be presented as well as the management of the Flexor Pollicis Longus repair.

Considerations for future practice will be discussed.
Donald Sammut is a Plastic Surgery trained Hand Surgeon based in the UK. His clinical practice is divided between Bath and London and deals exclusively with Hand Surgery. His particular interests include the reconstruction of hands following trauma or degeneration, Nerve and tendon surgery, the paralysed hand and Congenital Hand Malformations.

He is a frequent lecturer at National and International scientific meetings. He is a teacher and mentor for surgeons in Hand Surgery.

He runs regular Anatomy dissection courses, and Operative technique courses of the Upper limb. He is a Lecturer in Anatomy at the University of Bristol.

Over the past 20 years he has travelled regularly to Nepal to reconstruct and reanimate paralysed hands in patients with leprosy, or the sequelae of scarring from burns, and especially to teach and train Nepali surgeons.

He is also an artist and an illustrator, of both medical and non-medical works.

www.donaldsammut.com
Gill decided on a career in hand surgery as a 3rd year medical student. She had a bumpy ride along a traditional training path involving multiple moves of specialty, home and region. After registrar training in Birmingham, with hand fellowships in Pulvertaft Hand Centre in Derby, Christine M Kleinert Institute for hand and microsurgery in Louisville and in Great Ormond Street Hospital, London, she was appointed as a substantive consultant to Stoke Mandeville Hospital, Aylesbury.

In 2007, she took over the congenital hand practice in Great Ormond Street Hospital from Paul Smith. She ran the congenital hand service for Edinburgh as an interim measure until Wee Lam was appointed and has supported other services. She now works part-time between Great Ormond Street Hospital and Chelsea and Westminster Hospital in London, with a practice concentrated on the upper limb, combining both plastic surgery and orthopaedic approaches to care.

Her research interests include radial ray dysplasia, epidermolysis bullosa and Apert syndrome.

She has been invited to speak internationally in USA, Malaysia, Pakistan, Saudi Arabia and Europe. She is an active member of the American and British hand societies. She is on BSSH Council, BSSH Instructional Course Committee, and is Chair of the Hand Training Interface Committee and is International editor on Hand e and The Hand.
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