

## AN ALTERNATIVE MANAGEMENT APPROACH TO THE TREATMENT OF COMPLEX PHALANGEAL FRACTURES:

# *The Poole Finger Traction Splint*

## A NON- INVASIVE SPLINTING SYSTEM

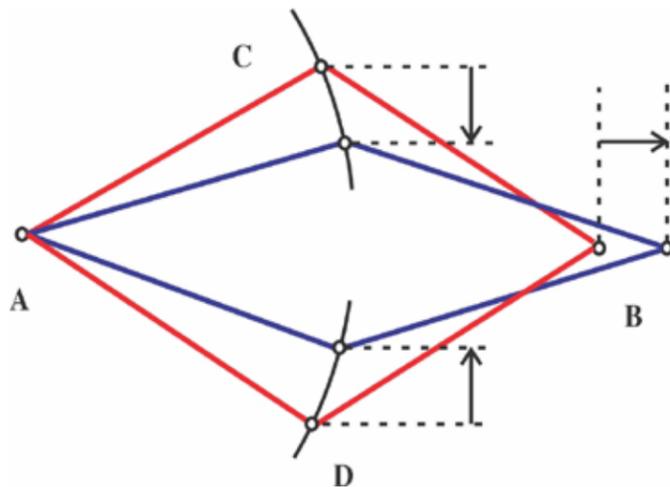
### Background

The management of acute complex phalangeal fractures present a challenge to both the surgeon and therapist as they are commonly unstable and difficult to treat. Several treatment options are available to the surgeon ranging from k-wires, screws and plates to various forms of traction. Many of these methods have the potential also to deliver complications such as post-operative stiffness, pain and infection.

Traction is often favoured as a treatment option as it uses the principle of ligamentotaxis which involves the application of distal traction to the digit that allows both the reduction of articular fragments and the realignment of joint surfaces by providing tension on their ligamentous and volar plate attachments (Schenk 1994), see Fig. 1.

The Poole Finger traction splint (PFTS) evolved in 2002 out of a clinical challenge of a highly comminuted base of middle phalanx fracture that was not conducive to surgical reduction. The task of stabilising the fracture was delegated to the hand therapy service; the 1st Poole traction splint was created and applied to the patient, with a successful outcome (Fig. 2). A literature review on traction methods strongly supported the

Fig 1. In the clinical application the proximal portion is fixed at point A, traction makes point B move distally, points C & D converge and move away from point A. If the capsulo-ligamentous and tendon structures are analogous to the horizontal lines they apply a vice like compression to whatever lies between them, e.g. dorsally displaced fragments, and the joint space is widened.



need for early mobilisation whilst maintaining fracture stability; there were other forms of non-invasive traction already in use at that time but none allowed for mobilisation, so this was prioritised.



Fig 2. The Original PFTS

A case series of 54 patients with 39% extra articular and 60% intra articular fractures enabled the collection of outcome data. A mean TAM of 220 degrees was demonstrated, which according to ASSH criteria represents a good outcome. There were no statistically significant differences between intra and extra articular fractures or those in the middle or proximal phalanges. In 2010 a MSc dissertation examined the feasibility of non- invasive traction in the context of all other forms of traction in use. (Bradley 2010).

This integrative review of the literature concluded that the PFTS was able to provide comparable outcomes and in some cases superior outcomes to other forms of invasive traction commonly in use. Traction systems in general are best suited to pilon type fractures though we have used them successfully in spiral, oblique and comminuted fractures in both the proximal or middle phalanges. Our experience as therapists with close collaboration of our surgical colleagues has led to a change in pathway in complex phalangeal fracture management which is now therapy led.

### Splint principles

The splint base is made of a thermoplastic that must be drapeable, e.g. orfit colours, tailorsplint. The splint base is moulded according to the characteristics of the fracture pattern, e.g. a dorsally angulated proximal phalanx fracture that is shortened would be splinted

with the MCPs in flexion to offload the interossei whose forces are pulling the proximal fragment into flexion and the distal fragment into extension. In contrast a comminuted pilon fracture may be splinted with the digit in extension in order to optimise the ligamentotaxis effects. Critical to the ligamentotaxis effect is the stabilisation of the digit proximally by applying a non-elastic tape across the proximal phalanx.

The traction is achieved by attaching a theraband strip from a frame that extends beyond the end of the digit to the nail which has a dressing hook attached to it with superglue. Our learning from early experiences of the splint prompted the addition of zinc oxide tape over the hooks base which distributes the forces away from the nail bed which, without it can cause nail avulsion, especially in cases where there is severe comminution or shortening where more traction is required. (Fig.3).

Traction tension is set by assessing pain with passive motion, in general when traction is sufficient more motion is afforded with less pain, and the effect is immediate. This is a pragmatic simple method that requires no complex measuring system or an x-ray to evaluate fracture reduction. In general blue theraband is now used as this allows for adequate traction tension without fatiguing too quickly between appointments. Any digit including the thumb and multiple digits can be managed effectively in this system. (Fig.4).



Fig 3. A hook is superglued to the nail and reinforced with zinc oxide tape



Fig 4. An example of the PFTS applied to 3 digits

#### The exercise regime (Fig.5).

In the first week the patient bends the wire passively flexing and extending the finger within a comfortable range. This is repeated 10x every hour. It can be modified according to the individual's response. On occasion no movement has been instigated where the fracture is highly unstable or pain is prohibitive, though this is rare. Pain relief in general is immediate. The splint remains in situ 24/7 in order to maintain tension through healing. An x-ray is taken at the return visit at the beginning of week 2 to assess fracture position in the PFTS. The decision to continue with treatment is made however based on clinical presentation.

In the main patients report a reduction in pain, increase in ROM and a reduction in swelling. When they return at week 2 the splint traction is replaced; it will be too long where the band has slackened from the increase in digit length and will fatigue a little from the exercise. Their hand is cleaned briefly and a cotton liner renewed. Then the patient's comfort with active

assisted motion is assessed, if this is manageable with no significant increase in pain then this is started in order to get some tendon glide over the fracture site. The patient will attend weekly and maintain the splint for 3-4 weeks, specifically until clinical healing has taken place. Thereafter usual hand therapy treatment approaches are used to address any residual ROM and function deficits.



Fig 5. The exercise regime

#### What have we learnt?

The journey so far has delivered some unexpected findings. We have consistently found there to be a radiological mismatch to function. It has taken some time to develop confidence to trust in the functional outcomes versus the radiographic findings. In a case example below of a 17 year old boy who injured his thumb playing rugby the traction was applied within 1 week post fracture.

His fracture can be seen in Fig.6. He had 5 treatments in total. He recovered a pain free ROM as follows: MCP 2-48, IPJ 10-70. A Kapandji score of 9 was achieved, Power grip was 100% and a tripod pinch 73% of the contralateral hand. QDASH score was 0 as assessed at 6 weeks post fracture.



Fig 6. The original fracture, lateral and b) In traction. Full anatomical reduction of the fracture is not always seen on the Xray in traction, however functional ability improved significantly

Other benefits noted have been the rapid reduction in oedema, rarely are oedema management modalities used in combination with the splint. The biggest benefit is clearly that the patient is spared an operation and there have been significant cost savings.

#### The Future

In 2015 The PFTS was recognised in the UK healthcare system having won an innovations grant which has enabled the development of a training programme to disseminate the PFTS into the NHS throughout the UK. The system has been adopted by seven NHS Trusts to date. It has also been recognised by Health Education England, who awarded me a NHS Shine award for innovation.



Fig 7. Examples of the Poole Finger Traction Splint

The work of the Poole Hospital Hand therapy team has been shared at national conferences in the UK, and internationally at the IFSHT Argentina 2015 and Berlin 2019 Congresses. The next step is to undertake further research to facilitate further national and international adoption.

#### References:

Schenk RR. The Dynamic Traction Method – combining movement and traction for intra-articular fractures of the phalanges. *HandClinics*. 1994b; 10: 187-198.

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