

ORTHOPAEDIC LOWER AND UPPER LIMB EXTERNAL FIXATION DEVICE: MANAGEMENT & CARE - CHW

POLICY

DOCUMENT SUMMARY/KEY POINTS

- Definition of an external fixation device and orthopaedic conditions that can be treated with the use of external fixation.
- Pre-operative requirements for the child and family.
- The general principles required when caring for a child with an external fixation device post-operatively.
- Pin site management and wound management.
- Distraction or leg lengthening management.
- Potential complications that may occur following application of an external fixation device.
- Requirement necessary before discharging a child with an external fixation device.
- Evidence to support guideline on managing an external fixation device.

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1 st April 2023	Review Period: 3 years
Team Leader:	Clinical Nurse Consultant	Area/Dept: Orthopaedics - CHW

CHANGE SUMMARY

Summary of changes to the revised document:

- No major changes. Updated references. Added Jet-X and images of all external fixation devices.
- Physiotherapy: Hydrotherapy updated.
- Literature review performed.
- References updated.

READ ACKNOWLEDGEMENT

- RN, EN and Physiotherapy staff caring for children with external fixation devices must read and acknowledge (sign-off) they have read and understood the contents of this document.
- Identified medical staff should be aware of this document.

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.





Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1 st April 2023	Review Period: 3 years
Team Leader:	Clinical Nurse Consultant	Area/Dept: Orthopaedics - CHW

TABLE OF CONTENTS

Definition	4
General Principles	5
<hr/>	
Trauma Patients	5
Pre-Operative Preparation	5
Post-operative Management	6
<hr/>	
Observations	6
Hydration	6
Pain management	6
Wound Management	6
1. <i>Pin site Management</i>	6
2. <i>Osteotomy Wound Management</i>	7
Distraction (turning regime)	8
<i>Hexapod Frame (TL-HEX or TSF)</i>	8
Personal Hygiene/Clothing	9
Physiotherapy.....	9
Optimal Outcome	10
<hr/>	
Self- care	10
Mobilisation	10
Potential Complications	10
<hr/>	
Neurovascular impairment	10
Pin site infections	10
Joint and muscle contractures.....	10
Requirements for Discharge	11
References	12
<hr/>	

Definition

An External Fixation device involves a system of pins and wires connected to an external frame. The device has been described as an instrument designed to stabilise and maintain the position of a bone. These devices can also be used to lengthen and correct rotational deformities of the bone. Fixation devices are frequently used for patients with fractures, non-union or mal-union, limb length discrepancies and limb deformities^{4, 3}. There are a number of devices used for external fixation, such as the:

<p>Trauma Frame: Lower limb</p> <p>Used to treat foot deformities and ankle fractures.</p>	 <p>ILIZAROV[®] External Fixator</p>
<p>Circular Hexapod Frame (TL-HEX or TSF)</p>	 <p>TAYLOR SPATIAL FRAME[®] External Fixator</p>
<p>Hoffman Fixator</p>	
<p>Jet-X (MRI compatible*)</p>	

The use of these devices depends on the type of condition being treated.

* For MRI 1.5T, the centre of the JET-X Bar fixator frame must be positioned at least 30cm from the isocentre of the bore. MRI 3T has no positional restrictions¹¹.

General Principles

Trauma Patients

1. Frames are used for complicated lower limb fractures: Comminuted and segmental fractures/skin loss ⁷
2. Application of the external fixation frame will be applied in theatres as soon as possible
3. If there are skin integrity issues such as de-gloving the Plastics Team will be contacted and manage this aspect of care
4. If the child requires debridement and skin grafts, pin site care is delayed until the graft sites are stable.
5. Monitoring of the child's neurovascular status is of importance during the first 72 hours
6. Follow post-operative guidelines as per elective patients having limb lengthening/correction surgery except for the Distraction Program unless otherwise requested by the Orthopaedic Surgeon.

Pre-Operative Preparation

1. Parent and child receive appropriate information in relation to procedure and after care by medical and nursing staff. It is important that the family and health professionals outline the desired goals and outcomes associated with the procedure.
2. Discuss approximate length of hospital stay with family.
3. Commence organisation of community supports if home care is required after discharge.
4. Blood check for Vitamin D levels: If low commence Vitamin D supplements⁹
5. If child is of school age, liaise with CNC in relation to re-integration back to school following procedure.
6. Check skin integrity.
7. Check vital signs, temperature, pulse, respirations, and blood pressure.
8. Check consent form.
9. Fasting times and premedication to be ordered by anaesthetist.

Post-operative Management

Observations

- Elevate the limb on pillows and raise the appropriate end of the bed. The affected limb should be maintained at heart level. This will reduce swelling and enhance the neurovascular status to the affected limb¹⁰.
- [Neurovascular observations](#) are to be recorded hourly for a minimum of 24 hours, or until stability of the extremity is attained. Be aware of possible complications such as nerve impairment and compartment syndrome¹⁰. A foot-plate maybe required if the device is applied to the tibia to maintain ankle range of motion.
- Record vital signs hourly. When narcotic infusion is ceased, 4/24 temperature, pulse, respirations and blood pressure until discharged.

Hydration

- Monitor input and output on fluid balance.
- Commence clear fluids as desired. If tolerating oral intake upgrade to normal diet.

Pain management

- Pain team consultation.
- Opiate infusion, as ordered, as per [Pain Management Practice Guideline](#)
- Regular paracetamol as ordered.
- Oral opiate when tolerating oral diet and infusion is ceased.

Wound Management

- Leave dressings intact for 5-7 days post-surgery.
- Commence daily dressings to pin sites day 5-7 post surgery.

1. Pin site Management

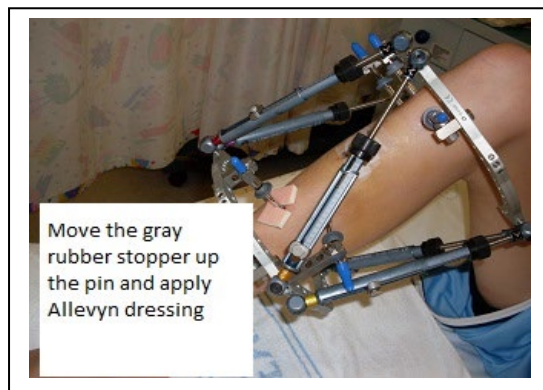
Equipment required for cleaning pin sites:

- Dressing pack
- Gloves
- Normal Saline
- Sterile Scissors
- Sterile Cotton Buds
- Foam dressing

Procedure:

1. Adhere to [ANTI](#) principles.
2. Organize equipment. Cut sheets of foam dressing into the required number of pieces example 1 sheet of foam dressing can be cut into 12 pieces for pins and 16 pieces for wires. Cut a keyhole into each piece of foam dressing.
3. Take the child to the shower and provide a shower chair.

4. Saturate dressings with warm water in the shower to dissolve dried blood and enable easy removal. This will prevent soft tissue damage. Slide clips up pin/wires and remove Foam dressings. Discard all Foam pieces ready to replace with new ones. Wash limb with warm water, then rinse and dry leg and device^{8, 12}. It is important not to pull or tear the skin around the pin sites. Baths are not recommended for children with external fixation devices, as bath water might contaminate the wounds^{8, 12}.
5. Position child in bed, clean pin/wire sites with normal Saline using a sterile cotton bud. Always clean away from the pin/wire in one direction to prevent microbial transfer into the pin⁵. Use a new sterile cotton bud for each pin or wire. Remove any crusts from around the pin or wire site, this promotes free drainage and prevents skin from adhering to the pin or wire³. However, it is important to note that scabs should never be removed as they are an essential part of the healing process^{8, 12}.
6. Apply Foam dressing around pin or wire. Place stopper/clip on pin or wire to hold the Foam against the skin with enough pressure to make a slight indentation. This helps to prevent movement of the skin which will reduce the risk of infection^{8, 12}. See below.



Note:

- Foam dressings are only required for the first two weeks following surgery. After this time Foam dressing is only used for persistent pin site infections.
- Chlorhexidine 0.1% can be used for persistent pin site infections^{3,8}

Parents are taught how to perform pin site dressings, written instructions and guidelines are available and need to be given to the parents.

2. Osteotomy Wound Management

- Adhere to [ANTI](#) principles
- An Osteotomy may also have been performed when the fixator was applied.
- Change dressing when commencing pin site care.
- Swab with normal saline and apply a primapore dressing, cover with a waterproof dressing.
- Remove sutures or staples as instructed by orthopaedic consultant.
- The dressing (*osteotomy sites*) should then remain intact until the child is seen in Outpatients.

Distraction (turning regime)

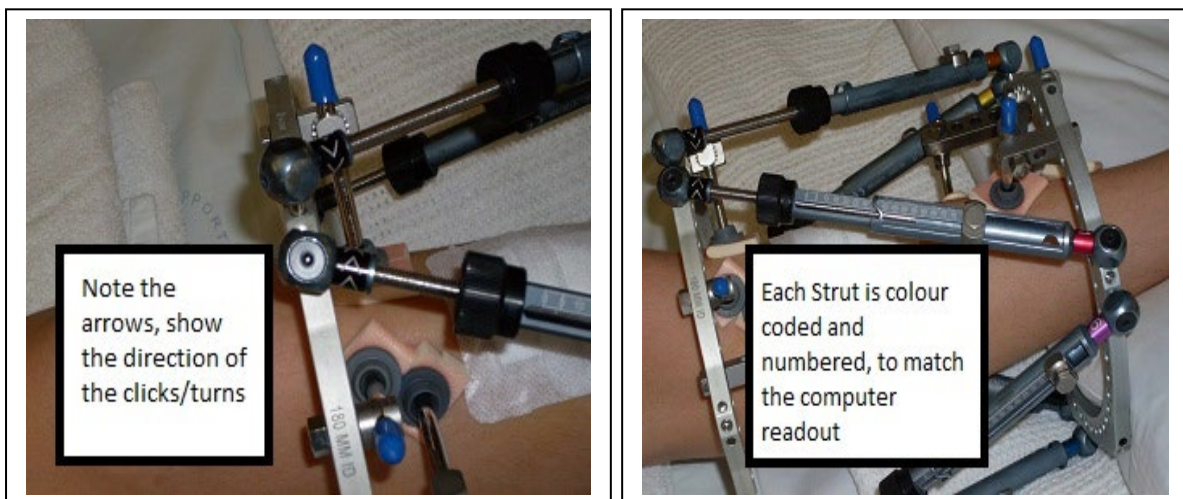
- Not all children who have an external fixation device applied need to undergo distraction/gradual correction. Distraction /lengthening/ correction is commenced 5-8 days post-operation. Instructions on when to commence clicks/turns will be documented in the child's post-operative notes.

Hexapod Frame (TL-HEX or TSF)

- The rate of turning is determined by a computer program. A post-operative x-ray is required before turning commences. The surgeon will deliver the computer readout to the unit. This readout outlines the required daily clicks/turns.
- Each strut is colour coded and numbered to coincide with the computer readout/prescription.
- TLHEX: Do the amount of 'clicks' recorded on the prescription in the direction of the arrow on the strut. (+) clicks go to the left and (-) clicks go to the right
- TSF: Turn each strut to the number that is recorded on the computer readout, which coincides with the appropriate date.
- Document the completion of each days clicks/turns in the child's medical records and on the computer readout.

The parents need to be taught how to do the clicks/turns by the nurse, the nurse's role is one of continuous education, supervision, observation and support.

TL-Hex Frame



Personal Hygiene/Clothing

- Daily showers when pin site care commences, assistance is needed to get in and out of the shower.
- The Occupational Therapist will arrange equipment for the home e.g., Shower chair / wheelchair.
- The Sewing room can adjust clothing for children that have had a trauma injury. All elective lengthening patients should be instructed pre-operatively to adjust clothing.
- Track pants with an added panel and Velcro fastening are ideal for tibial or femoral fixation devices. Long skirts are also an option.

Physiotherapy

- Physiotherapy is an important part of the child's post-operative recovery.
- The goal of physiotherapy is:
 - To help the child maintain functional movement of the joint above and below the fixation device.
 - To promote and assist the child to be as independent as possible with his/ her mobility program (weight bearing fully promotes bone healing).
 - To prevent contractures of surrounding muscles and joints.
- A Physiotherapist will see the child day 1 post operatively to commence bed exercises, to maintain leg strength and range of motion of the joints and muscles above and below the fixation device.
- When requested by the orthopaedic surgeon, the physiotherapist will commence mobilizing the child. Weight bearing status must be specified by the surgeon prior to mobilizing the child. Some children require assistive devices such as a walking frame or crutches to mobilize. The correct use of this equipment will be taught by the physiotherapist
- Prior to discharge the physiotherapist on the orthopaedic ward will have a home program for the patient to continue and will ensure that an outpatient physiotherapy referral is placed for follow up therapy at the patient's local hospital. Contact Page 6385.
- Hydrotherapy is recommended 3 weeks post-surgery, (if able to be resourced). Hydrotherapy does not increase the risk of wound infections; in fact, it helps keep the pin sites clean and free of crusts whilst improving range of motion of joints⁶

Please refer to the Guideline: [Lower limb lengthening and deformity correction: For physiotherapy management](#) of the child with an external fixation device

Optimal Outcome

Self-care

Promote maximum self-care for the child and family. Frustration with mobilisation and problems associated with body image need to be acknowledged and discussed openly. Encouragement and support for both the family and child is necessary in relation to pin site care and the turning regime¹.

Mobilisation

Prior to discharge the child should be able to mobilise safely with the use of walking aids, such as crutches or a frame within the home. For school and other outdoors activities a wheelchair will be organised. If the fixator is in place for lengthening; full weight bearing is encouraged and is essential for the development and consolidation of new bone².

Potential Complications

Neurovascular impairment

- Neurovascular assessment in the first 24 to 48 hours is essential, if a child has extreme pain, loss of active and passive motion, loss of sensation and swelling it may indicate compartment syndrome. The orthopaedic registrar should be called immediately².
- The wires and pins inserted are sometimes close to the nerve and blood supply of a limb; and a bruised nerve can alter sensation and movement of a limb. Foot drop can be a result of a nerve damaged by a pin or wire⁵.

Pin site infections

- Inflammation of a pin site is a common complication, and many children experience pin site infections. Parents should be taught how to identify a pin site infection and know what action to take. An Action Plan is provided with the pin site care instructions^{4, 12}. Refer to [Pin Site Care Homecare Guideline](#).

Joint and muscle contractures

- Stiff joints, especially around the ankle and the knee can lead to muscle contractures. Regular physiotherapy and passive/active exercises performed by the patient can prevent this from occurring. A Physiotherapy plan should be developed, and parents instructed on exercises before discharge^{8, 12}. Foot plates may be required for children with a device applied to the tibia to prevent ankle contracture. The Orthotic Department will provide and fit the foot plate.

Requirements for Discharge

- Inform the parents the importance of hand hygiene during change of dressing
- Parents/child can demonstrate confidence with pin site care and clicks/ turning regime.
- Parents have 2x10mm or 2x8mm spanners (for Ilizarov frames)
- Parents have pin care instructions and action plan.
- Parents have booklet to record clicks/turns.
- Child is mobilising safely.
- Dressing equipment at Westmead Campus: Appliance Centre (Level 2 Galleria)

Items that are needed at home for a two-week period include:

- Sterile Cotton buds (only for 2 weeks then able to use supermarket supplies)
- Foam Dressing
- Suction Packs (used instead of a dressing pack) by parent/carer
- Instruct parents to obtain normal saline from local chemist.
- Mobilisation aids arranged.
- Splints or foot plates arranged through Orthotic department.
- Parents instructed to check device weekly for loose bolts and screws.
- External prescription for oral antibiotics given to parents (to be used only if child develops a pin site infection).
- Follow-up appointments arranged in Limb Lengthening Clinic.
- Physiotherapy outpatient appointments arranged and Hydro-Therapy pre-arranged to commence once osteotomy wound healed (3 weeks post-op)
- Contact phone numbers of health professionals given to parents.

Note: 0.9% sodium chloride to be used at home as the cleaning solution.

References

1. Abulaiti, A., Yilihamu, Y., Yasheng, T., Alike, Y., & Yusufu, A. (2017). The psychological impact of external fixation using the Ilizarov or Orthofix LRS method to treat tibial osteomyelitis with a bone defect. *Injury*, 48(12), 2842-2846.
2. Ahluwalia, A., Tiwari, K., & Somashaker, N. (2020). Acute compartment syndrome in the limb. *British Journal of Hospital Medicine*, 81(5), 1-6.
3. Calder, P.R., Faimali, M., & Goodier, D., (2019). The role of external fixation in paediatric limb lengthening and deformity correction. *Injury Int. J. Care Injured* 50S S18-S23.
4. Ceroni, D., Grumetz, C., Desvachez, O., Pusateri, S., Dunand, P., & Samara, E. (2016). From prevention of pin-tract infection to treatment of osteomyelitis during paediatric external fixation. *Journal of Children's Orthopaedics*, 10(6), 605-612.
5. Kwok, I. H. Y., Silk, Z. M., Quick, T. J., Sinisi, M., MacQuillan, A., & Fox, M. (2016). Nerve injuries associated with supracondylar fractures of the humerus in children: our experience in a specialist peripheral nerve injury unit. *The Bone & Joint Journal*, 98(6), 851-856.
6. Lakkadsha, T. M., Jain, D., & Phansopkar, P. (2022). A Toddler's Rehabilitation Following Ilizarov's Tibial Pseudoarthrosis Fixation. *Cureus*, 14(7).
7. Lobst, C. A., (2016). Hexapod external fixation of tibia fractures in children. *J Pediatr Orthop*. Vol 36. No 4. Supplement 1. S24-S28.
8. Mann, E. (2016). Evidence Summary. External Skeletal Pin: Site Care. *The Joanna Briggs Institute EBP Database*, JBI171.
9. Rodriguez-Collazo, E., & Agyen, J. (2018). Peri-Articular Reconstruction for Intra-Articular Calcaneal Fractures Utilizing the Ilizarov Method with Orthofix Truelok Circular External Fixator: A Technique Guide and Orthoplastic Considerations. *Clin Surg*, 3, 1998.
10. Rodriguez-Collazo, E., Cummins, M., Bever, B., & Samchukov, M. (2019). Practical management of the Orthofix Truelok external circular fixator in deformity correction and lower limb salvage. *International Journal of Orthoplastic Surgery*, 2(2), 55-61.
11. *External Fixation Systems*. (2012). Smith & Nephew. Retrieved October 22, 2022, from [https://www.smith-nephew.com/global/assets/pdf/temp/external_fixation_\(english\)_81056329_c_2010-04_\(copy-1\).pdf](https://www.smith-nephew.com/global/assets/pdf/temp/external_fixation_(english)_81056329_c_2010-04_(copy-1).pdf)
12. Walker, J.A., Scammell, B. E., & Bayston, R., (2017). A web-based survey to identify current practice in skeletal pin site management. *International Wound Journal*. 15. 250-257.

Copyright notice and disclaimer:

The use of this document outside Sydney Children's Hospitals Network (SCHN), or its reproduction in whole or in part, is subject to acknowledgement that it is the property of SCHN. SCHN has done everything practicable to make this document accurate, up-to-date and in accordance with accepted legislation and standards at the date of publication. SCHN is not responsible for consequences arising from the use of this document outside SCHN. A current version of this document is only available electronically from the Hospitals. If this document is printed, it is only valid to the date of printing.