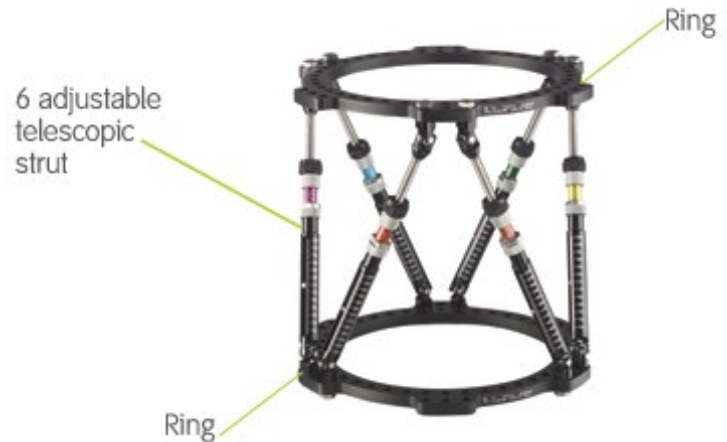


Limb Lengthening Via a Hexapod External Fixator: Patient Instructions

Hexapod External Fixator:

A hexapod external fixator is one type of circular external fixator used to gradually lengthen bones and correct a variety of limb differences. Two rings typically encircle the limb. Six struts hold the two rings together. Each strut is individually numbered and color coded. The struts are responsible for the lengthening of the underlying bone. The pins and wires are attached to one of the rings and go through the skin and anchor into the bone. Each strut should spin freely when attached to the rings, but at times, may not spin and that is okay. The patient will leave the operating room with a sterile dressing that will remain in place for the first 5-7 days after surgery. The surgical dressing will be removed by the orthopedic team and pin care/dressing changes will start after this time.



1 External Fixator: Two rings encircle the leg and are connected by six struts. The fixator is anchored to the bone and skin by pins and wires. **Video Resource** -Taylor Spatial Frame Components: <https://jwp.io/s/0dJ5Wlvr>

Procedure Details:

Surgery: Under general anesthesia the affected bone is cut (osteotomy) and a six-strut external fixator (hexapod) is attached to the bone with pins and/or wires on either side of the cut ends of the bone.

Latency phase: During the first week following surgery the patient remains at the hospital and in a sterile surgical dressing for the body to begin bone healing.

Distraction phase: Often the patient is transferred to the inpatient rehab floor, pin care and bone lengthening are initiated, typically 5-7 days after surgery. The patient and caretakers are taught to do pin care and perform gradual lengthening based on a customized computer-generated lengthening schedule that is specific for each patient, based on their underlying limb difference. The physical therapist will help with mobility, use of crutches/walker and demonstrate exercises to avoid stiffness and weakness of the involved limb.

Discharged home: Depending on progression (typically following a few days of inpatient admission), the patient is ready for discharge home and continues the lengthening process as instructed. Along with at home exercises, the patient attends outpatient physical therapy 1-2 times per week and is seen in the limb differences clinic every 1-2 weeks.

Lengthening Schedule:

Each of the six struts are color coded on the customized lengthening schedule to match the colors on the tab of the struts on the external fixator. Down the side, each row indicates a day on the prescription. Bone, nerves, and tendons are best lengthened in small doses multiple times through the day instead of a larger amount all at once. We typically recommend performing strut adjustments three times a day - such as at **breakfast, lunch, and dinner**. For instance, Strut 1 and Strut 2 can be lengthened in the **morning**, Struts 3 and 4 at in the **afternoon**, and Struts 5 and 6 at in the **late evening**.

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In the attached example, if the schedule says to go from 92 to 93 (strut 4, day 1), this will equal one full turn in the positive direction, that is to lengthen. If the schedule goes from 171 to 170 (strut 1, day 7), this will equal one full turn in the negative direction, to shorten the bone. If the schedule states that the number does not change (Strut 2, day 1), then you do not need to move that strut for that day.

Paper Schedule: Once the adjustment for each strut is completed, it should be crossed out and initialed. While in the hospital, the bedside nurse/ orthopaedic team will confirm that the adjustment is done correctly and document on the printed schedule that is displayed in your room. If there is an issue or a difference between the number indicated on the prescribed schedule and what is noted on the strut for that day, please contact the nurse or the orthopaedic team.

Phone App Schedule: with a QR code to document the lengthening. This is a convenient alternative to the printed schedule.

Strut Adjustment:

Each strut has a ruler with white numbers indicating the excursion and an indicator disc with a line that tells you the length of the strut currently. The strut has a knob at the top with an arrow and a plus

To lengthen, you will:

1. Loosen the top knob (Lock) and hold the black part of the strut.
2. Turn the adjustment knob with the plus sign and arrow.
3. One full turn of the knob corresponds to one millimeter of either lengthening (turning **towards** + sign) or shortening (turning **away** from + sign). When the knob is turned toward the + sign, the indicator disc or number marking moves up to the **higher** number and the bone is **lengthened**. When the knob is moved away from the + sign (towards the - sign), the indicator disc moves **down** to a smaller number and the bone gap is shortened.
4. Finger tighten the top knob (lock) when done adjusting the strut
5. An indicator (such as a whiteout) is painted on the knob to help families gauge when a full strut turn is made. You will also feel a slight click after one full turn.

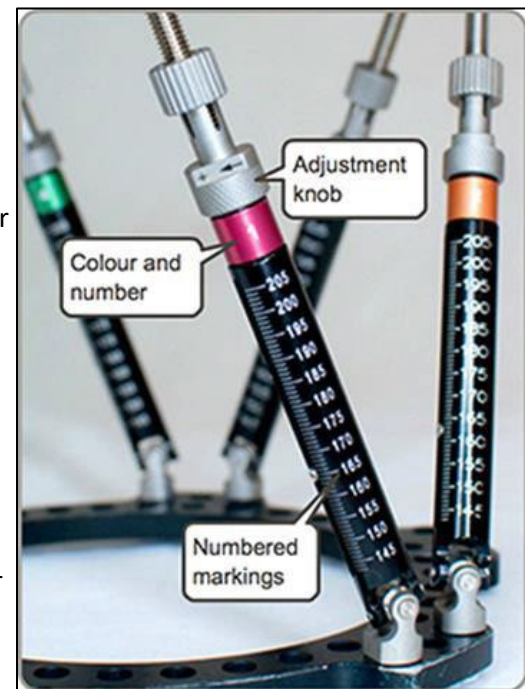
Please follow the instructions carefully. DO NOT adjust ALL SIX strut lengths at the same time. Based on the individual schedule, a strut may move up (lengthened), down (shortened) or not move at all.

Prescription

Date	WkDay	Day	Strut 1	Strut 2	Strut 3	Strut 4	Strut 5	Strut 6
02/21/19	Thu	0	171	108	152	92	75	145
02/22/19	Fri	1	171	108	152	93	77	145
02/23/19	Sat	2	171	109	153	95	78	146
02/24/19	Sun	3	171	109	153	96	80	146
02/25/19	Mon	4	171	110	153	98	82	146
02/26/19	Tue	5	171	110	154	99	83	147
02/27/19	Wed	6	171	110	154	101	85	147
02/28/19	Thu	7	170	111	154	102	87	147
03/01/19	Fri	8	170	111	155	104	88	148
03/02/19	Sat	9	170	111	155	105	90	148
03/03/19	Sun	10	170	112	155	107	92	148
03/04/19	Mon	11	170	112	156	108	93	149
03/05/19	Tue	12	170	113	156	110	95	149

2 The large color blocks indicate the need for a strut change (as demonstrated in the picture above on strut 5) and will be handled by the orthopaedic team.

Video Resource--Lengthening Schedule: <https://jwp.io/s/32TPux0Z>



3 Each Strut is located across the top columns and is color coded to match the colors on the struts on the external fixator. Down the side each row indicates a day on the prescription. Video Resource--Lengthening Struts: <https://jwp.io/s/QZ7eMyl>

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External Fixator Pin Care

Pin Site: is the area where the pin meets the skin. The opening must be kept clean to decrease the risk of pin-site infection. Infection can cause the pin to loosen, require its removal prematurely or the infection can spread into the bone. The correct care for your pin sites will allow for more comfortable healing and prevent additional surgeries.

Cleaning External Fixator and Pin Sites: After surgery, pin sites will be dressed with gauze and this dressing will remain in place for approximately 7-10 days or until pin care is started. You will be able to shower 7-10 days after surgery, once instructed by the orthopaedic team. While in the shower, gently clean your fixator and your skin with antibacterial soap and water. Unless cleared by your surgeon, do not submerge your pins under water (i.e., do not take a bath or get into a pool). Afterwards, dry the fixator thoroughly with a clean towel. Just after your shower, is the best time to start your pin care.

Infection: Even with proper pin site care, pin sites may still become infected. Call the Orthopaedic Clinic if your child has any of the following symptoms:

- Fever greater than 101.5°F
- Pain is not relieved by medicine
- Change in sensation (numbness, tingling, cool to touch)
- Wound infection:
 - Redness or swelling at the pin sites
 - Yellow, thick, or foul-smelling drainage around the pins

If you experience any of these symptoms, start the antibiotics prescribed by your provider and call the Orthopaedic Clinic Nurse. Make sure you take the antibiotics as prescribed (usually a 10-day course).

Tips: Follow your weight bearing restrictions prescribed by your doctor, at ALL times. **Do not use powders, lotions, or antibiotic ointment near the pin sites.** Avoid wet floors (rain, ice, snow) because you may slip. Wear loose fitting clothes. We encourage you to keep the external fixator covered if you are outdoors to avoid infection. A stretchy cotton covering to put over the fixator will be supplied, or you can purchase custom external fixator covers.

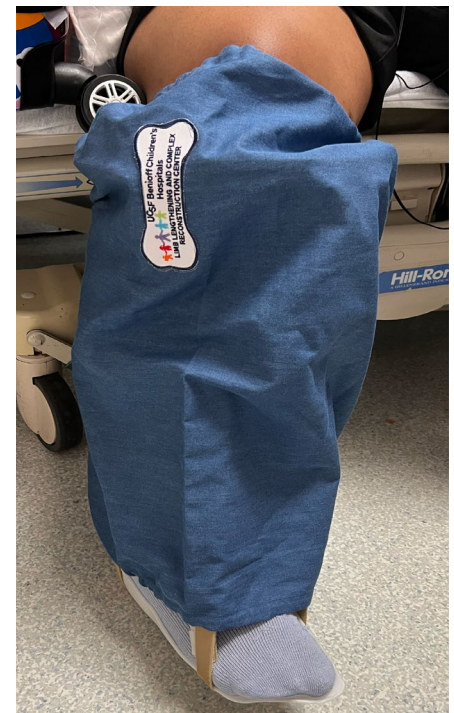
Exercises and Physical Therapy: There is a risk of developing stiffness and weakness of the affected limb throughout the lengthening process. It is very important to do exercises at home and regularly attend the physical therapy sessions as prescribed.

- You may position the limb to encourage a gentle stretch. For example, it is better to place a pillow under the lower end of the calf instead of under the knee to allow the leg to stay straight and not develop any flexion contractures.
- If any resting splints are provided, please use them as instructed.
- Dynamic stretching braces are sometimes ordered prior to surgery and customized for each patient's needs. They should be worn as directed by the orthopaedic team.

Diet: It is also important to maintain a healthy balanced diet. Taking supplemental Vitamin D can also help the bone heal faster.



2 Video Resource--
Lengthening Struts:
<https://jwp.io/s/QZf7eMyl>



4 A stretchy cotton covering to put over the fixator will be supplied, or you can purchase custom external fixator covers.



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Pin Care: Complete pin care once a day to keep the pins clean. **Video Resource**—Pin care: <https://jwp.io/s/fuWji0Bs>

Supplies:	For pins WITHOUT crusting:	For pins WITH crusting:
<ul style="list-style-type: none"> • 2 clean disposable cups (Dixie cups work well) • Normal Saline or Sterile water (Tap water can be sterilized by boiling for 10 minutes and let cool completely) • ½ and ½ mix of Hydrogen peroxide and normal saline/sterile water (Only needed if you have crusting on your pin sites) • Clean cotton swabs (Q-tips) • 2-inch by 2-inch Gauze squares (can be found in large packs at the drug store) • Clean scissors with alcohol to cut slits in the gauze (only used for pin care) • Paper tape (found in first aid section of drug store) 	<ol style="list-style-type: none"> 1. Wash Hands. 2. Fill one cup with sterile water/normal saline. 3. Remove old gauze squares and place in the trash, and then wash hands again. If the gauze is stuck, you may run normal saline or water over the site until they loosen. This will cause less pain and bleeding. 4. Check the pin sites for signs of infection including redness, tenderness, and thick, foul-smelling drainage. If signs of infection are present, call your orthopaedic provider. 5. Wet cotton swabs with the water/normal saline. 6. Gently clean skin around the pins, using friction to help remove drainage or scabs from around the pin site. Use a new swab with each pin site. 7. Cut a slit in the gauze square so that it will fit around the pin. 8. Put the gauze square around the pin and tape in place. 	<ol style="list-style-type: none"> 1. Wash Hands 2. Fill one cup with normal saline/sterile water and the other cup with ½ normal saline/sterile water and ½ hydrogen peroxide. 3. Remove old gauze squares and then wash hands again. If the gauze is stuck, you may run normal saline or water over the site until they loosen. This will cause less pain and bleeding 4. Check pin sites for signs of infection including redness, tenderness, and thick, foul-smelling drainage. If signs of infection are present, call your orthopaedic provider. 5. Wet cotton swabs with <u>water/hydrogen peroxide mixture</u>. 6. Gently clean skin around the pins, using friction to help remove drainage, crusting or scabs from around the pin site. Use a new swab with each pin site. 7. Gently remove crusts as they are loosened. 8. Wet new cotton swabs with <u>water from the cup</u>. 9. Gently rinse the pin sites. Use a new swab for each pin site. 10. Cut a slit in the gauze square so that it will fit around the pin. 11. Place gauze square around the pin and tape in place.

Consolidation phase: Once the desired bone alignment/length is achieved, further adjustment of the struts is stopped, and the struts are taped to avoid any unanticipated turns. The clinic visits are less frequent as we wait for the lengthened bone to get stronger. The patient is allowed to put full weight on the lengthened leg and gradually wean off crutches. After the bone has been deemed strong enough, we remove the fixator under general anesthesia as a same-day outpatient procedure.

Contact Information:

If you have a question or concern about your child, please call us:

- Weekdays (8 am - 4:30 pm): 510-428-3238 and ask to speak to your surgeon's nurse
- After 4:30 pm or Weekend/Holiday: 510-428-3000 (main hospital number) and ask to speak to the orthopedic resident on-call