

Division of Orthopaedic Surgery

How to Lengthen an External Fixator

What is the process of a limb lengthening?

Lengthening is often the preferred method as it allows your child to reach their full height. Limbs can be lengthened by devices that are either visible from outside (external fixation) or are completely inside of the body (intramedullary rods). Both forms of lengthening take advantage of the body's natural ability to grow bone. With both types of lengthening, the surgeon cuts the bones in half with special instruments that do not injure the tissues surrounding the bone. This helps to preserve the bone covering (periosteum) that will help make new bone as the bone ends are slowly stretched millimeter by millimeter through either the external or internal device every day until the goal is reached. The body fills in the gap between the two bone ends with new bone, correcting deformities and increasing length. After reaching the desired length or correction, the device remains in place until the bone fully hardens or consolidates. After the bone has hardened, the device is removed. The entire process can take a few months to complete.

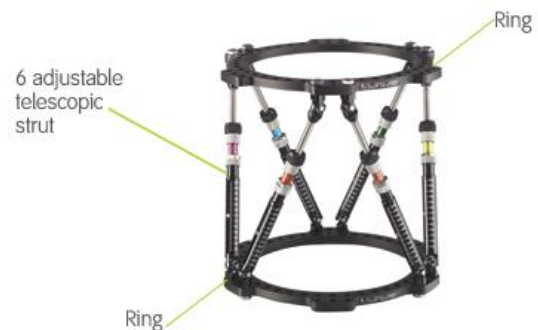
What is an external fixator?

For external lengthening and deformity correction, a frame called an "external fixator" is used to lengthen and/or straighten the bone. This is the traditional method of treatment and has been used successfully for many years. After the surgery to separate the bone, a frame is anchored to the bone and skin through pins and wires. For the first week post-op, your child remains in a sterile, surgical dressing as we wait for inflammation to build to promote bone healing. Your child is usually transferred to the inpatient rehab floor when they are ready for acute rehab.

You will be provided a customized lengthening schedule generated by the computer and you and your child will be taught how to turn the dials of the six struts on the external fixator according to the schedule. Lengthening usually starts around 5-7 days post-op. Each turning of the strut increases the space between the bones and allows new bone to slowly form.

What are the different components of an external fixator?

Two rings encircle the limb. There are six struts that hold the two rings together. Each strut is individually numbered and color coded. The struts are responsible for the lengthening. The pins and wires go through the skin and anchor into the bone. Each strut should spin freely when attached to the rings.



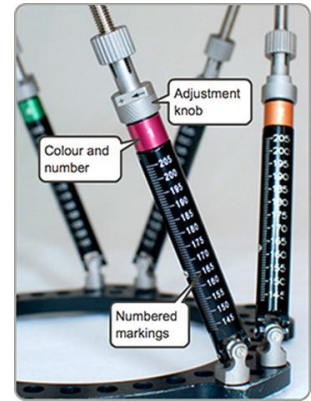
How do you lengthen the strut?

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 sign.

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To lengthen, you will:

- 1) Loosen the top knob
- 2) Hold the black part of the strut
- 3) Turn the knob with the plus sign and arrow in the direction required based on your child's lengthening schedule
- 4) Tighten the top knob when done



A drop of red nail polish is placed on the knob to help families gauge when a full circle is made. You will also feel a slight click after one full circle.

Each full turn of the knob corresponds to one millimeter of either lengthening or compression. When the knob is turned toward the plus sign, the indicator disc moves up to the higher number and the bone is lengthened. When the knob is moved away from the plus sign, the indicator disc moves down to a smaller number and the space is compressed.

What schedule do you follow for lengthening a Taylor Spatial Frame?

Lengthening occurs based on a computerized daily schedule that will be printed, color coded and placed on the wall and also available on a phone app. On the schedule, Day 0 occurs prior to the start of lengthening. This does not correspond to post-op days. Each Strut is located across the top columns and is color coded to match the colors on the struts on the external fixator. Each row indicates a day on the prescription.

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

Bone forms better if lengthened in small doses multiple times through the day instead of a larger amount once a day. Therefore, we use regular 8-hour intervals such as a breakfast, lunch and dinner schedule for lengthening. Strut 1 and Strut 2 will lengthen in the morning. Strut 3 and 4 at in the afternoon and Strut 5 and 6 at in the late evening.

Struts may move up, down or not at all. For example, if the schedule says to go from 170 to 171, this will equal one full turn in the positive direction, to lengthen. If the schedule goes from 95 to 94, this will equal one full turn in the negative direction, to compress the bone.

We encourage you to take ownership of the lengthening and document on the wall schedule. Once a lengthening is completed, it should be crossed out on the printed schedule and initialed. The large color blocks on the printed schedule

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indicate the need for a strut change. You may also want to download an application on your phone to document the lengthening which allows the physician to be notified if you are delinquent. The bedside nurse should assess the lengthening is done correctly and document on the wall chart. If there is an issue or a difference between the number on the wall schedule and the strut, you should contact the orthopaedic team.

What other important things should I know as I care for my child?

Risks of an external fixator include pin tract infections or breakages, nerve or vascular damage, soft tissue tethering around pins or wires, bone weakening while in fixator and risk of contracture of nearby joints.

Regardless of the type of lengthening, it is important that your child is compliant with rigorous physical therapy to avoid joint stiffening or contractures as the bone is lengthened and the surrounding muscles need to stretch to accommodate the new length. Dynamic stretching braces are order pre-op and customized for your child's needs. They are fitted post-op and should be worn over night. The inpatient PT/OT will work together to create a splint such as a cast shoe with Velcro attached to the rings to hold your child's foot neutral during the day. This daytime splint can be removed for range of motion and for short breaks. The goal of daily bracing is approximately 20 hours a day. Please let the team know if there are issues with either brace so they can be corrected before skin breakdown occurs.

Video Resources:

Taylor Spatial Frame Components: <https://jwp.io/s/0dJ5Wlvr>

Lengthening Struts: <https://jwp.io/s/Qzf7eMyl>

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

Pin Care: <https://jwp.io/s/fuWjiOBs>