



# HEIGHT BLUEPRINT

STANDARD GUIDE

---

## Understanding limb lengthening

Methods | Risks | Recovery

A free introductory overview

By Lucas

General education to help you ask informed questions



## 01 THE BASICS

# Start with the whole process

Limb lengthening is major orthopaedic surgery followed by a prolonged period of healing and rehabilitation. This guide explains the vocabulary and main treatment approaches so you can have a more informed conversation with a qualified limb-reconstruction surgeon.

It cannot decide whether surgery is suitable for you or set a safe target, device setting, exercise plan or recovery deadline. A longer bone is only one part of the outcome; comfortable movement and everyday function matter too.

## How new bone forms

In a controlled operation, the surgeon divides a bone. A device then gradually separates the bone sections while new bone forms in the gap. This is called **distraction osteogenesis**. The new bone must later strengthen before it can tolerate unrestricted loading. [1], [2]

## The bones you will hear about

The **femur** is the thighbone. The **tibia** is the larger shinbone. Treating the thigh and treating the lower leg involve different anatomy, joints and soft tissues. Your assessment determines which approach, if any, is appropriate. [1], [7]

## Inside this guide

External and internal methods 3

Hybrid methods LON and LATN 4

Bilateral and quadrilateral lengthening 5

Lengthening and recovery phases 6

Risks and warning signs 7

Questions for a consultation 8

Sources 9



## 02 COMPARING APPROACHES

# External and internal methods

The words external and internal describe where the lengthening hardware sits. They do not by themselves tell you which option is safest or most suitable for a particular person.

## External fixation

A frame outside the leg connects to the bone through pins or wires. The frame controls the separation of the bone sections and supports the treated bone. In an external-fixation-only approach, it can remain in place through both lengthening and consolidation. [2]

Important considerations include pin-site care, frame-related discomfort, movement restrictions and the length of time the frame is needed. A frame can also be used for correction of deformity; the exact plan varies.

## Fully internal lengthening nails

A lengthening nail is placed inside the bone. Its telescoping mechanism gradually extends without an external lengthening frame. **PRECICE** uses a magnetic drive controlled from outside the body. **FITBONE** uses an electromechanical motor with an implanted receiver and an external transmitter. [3], [4]

These systems avoid external pin sites, but not surgical or deep infection, hardware problems or other complications. Weight-bearing limits depend on the exact implant and treatment plan. Later implant removal also needs discussion. [3]

## Compare the complete plan

Ask about the exact device, current local authorization and safety notices, planned operations, follow-up, restrictions and management of complications. A device name or advertised height gain is not enough to judge a treatment.



## 03 EXTERNAL FRAME AND INTERNAL NAIL

# Hybrid methods LON and LATN

Hybrid approaches combine an external frame with an internal nail. **The timing of nail insertion is the key distinction between LON and LATN.** The summaries below show the broad sequence, not operating instructions.

## LON means lengthening over a nail

The nail is already inside the bone during frame-based lengthening. The external frame performs the gradual lengthening. After distraction, the surgeon secures the nail and removes the frame; the nail then supports the bone while consolidation continues. [5]

**Broad sequence** Frame and nail during lengthening > frame removed > nail supports consolidation

## LATN means lengthening and then nailing

The external frame performs lengthening first. An intramedullary nail is inserted afterward, during a later operation, to support consolidation and allow frame removal. Unlike LON, the nail is not in place during the initial frame-based distraction phase. [6]

**Broad sequence** Frame-based lengthening > nail inserted and frame removed > nail supports consolidation

## What both approaches require

Both involve external pin or wire sites, an internal implant and surgical stages beyond the initial bone division. Infection, alignment, nerve and joint problems, healing difficulties and unplanned surgery remain possible. Frame removal is not proof of complete bone healing. [2], [5], [6]

Do not assume these approaches have identical risks, recovery times or suitability. Ask the surgeon why the proposed sequence fits your anatomy and goals, and what happens if healing does not progress as expected.



## 04 WHICH BONES ARE TREATED

# Bilateral and quadrilateral lengthening

These terms describe the number and combination of treated bone segments. They do not describe the lengthening device.

## Bilateral lengthening

Bilateral means both sides. In height-lengthening discussions, it commonly refers to a matched pair: **both femurs or both tibias**. Confirm exactly which bones the surgeon means when using the term. [7]



## Quadrilateral lengthening

Quadrilateral lengthening refers to **both femurs and both tibias**: four treated bone segments. This may be planned in stages. It does not automatically mean all four bones are lengthened in one operation or at the same time. [7], [10]



## A larger plan needs a complete assessment

Treating four segments expands the scope of surgery and rehabilitation. Ask how the stages affect mobility, joints, soft tissues, assistance needs and follow-up. Do not assume that doubling the number of segments simply doubles the height gain, recovery time or risk.

There is no universal safe maximum gain for every person. Goals and stopping decisions must consider anatomy, soft-tissue tolerance, symptoms, bone formation and function. A successful result for someone else does not establish a safe target for you. [1], [3]

Illustrations are simplified segment maps, not surgical or anatomical plans. Darker segments indicate the example bones being discussed.



## 05 HEALING TAKES MORE THAN ONE MILESTONE

# Lengthening and recovery phases

## Latency

After the bone is divided, there is an initial healing interval before distraction begins. The team decides when to start; a generic timetable cannot replace your own plan. [1], [2], [3]

## Distraction

The device gradually separates the bone sections while new bone forms. Muscles, nerves, blood vessels and other soft tissues must also adapt. Examinations and imaging help the team decide whether to continue, adjust, pause or stop. [1], [2], [3]

## Consolidation

Lengthening has stopped, but the new bone still needs to harden and strengthen. Protection and monitoring continue. Reaching a target length and being ready for unrestricted walking or sport are different milestones. [1], [2], [3]

## Rehabilitation throughout

Rehabilitation works on movement, strength and daily function. Physiotherapy may begin early and continue through distraction and consolidation, rather than starting only after bone healing. [1], [2], [3]

## Think in separate milestones

Ask for individual estimates for walking, work, driving, travel and sport, and what evidence is needed for clearance. Recovery commonly takes months and can last longer than expected. Follow-up and later operations are part of the overall commitment.

The phases describe biological healing and rehabilitation. They are not a fixed count of operations, and they do not provide permission to change a device or weight-bearing restriction.



## 06 SAFETY COMES BEFORE A HEIGHT GOAL

# Risks and warning signs

Complications can require further surgery and may cause lasting pain or disability. Discuss your individual risks and alternatives before deciding. This is an overview, not a complete surgical consent list. [1], [2], [3]

**Infection.** Wound, pin-site or deep bone/implant infection.

**Nerve or blood-vessel injury.** Changes in sensation, weakness or circulation; effects may persist.

**Joint and soft-tissue problems.** Muscle tightness, stiffness, contracture or instability.

**Bone-healing problems.** Slow or failed healing, premature hardening, alignment problems or fracture.

**Hardware problems.** A device can malfunction, break or need another operation.

**Blood clots.** Clots in a leg can travel to the lungs and become life-threatening.

## Get emergency care

New breathlessness, chest pain, coughing up blood or collapse needs emergency assessment. Seek emergency care for sudden severe limb pain, or severe persistent pain with a pale or cold limb, tense swelling or new loss of movement. Do not wait for all signs. [3], [8], [9], [11]

## Get urgent clinical advice

New unexplained leg swelling or pain, numbness or weakness, spreading wound redness, discharge, fever or a new device problem needs prompt advice. Ask for written warning signs and an out-of-hours contact. If you cannot reach the team, use appropriate local urgent or emergency care. [2], [3], [8]



## 07 GET ANSWERS YOU UNDERSTAND

# Questions for a consultation

Use these questions to understand the whole treatment plan. An independent assessment can help you weigh the likely benefits, limits and alternatives without pressure to book.

- 1. Suitability.** Why am I a suitable candidate, and what could make you advise against surgery? What are the alternatives, including not having an operation?
- 2. Bones and device.** Which bones and exact method would you use, and why? Is the device suitable and currently authorized for this use where treatment will take place?
- 3. Goals and stopping points.** How would you set a target after assessing me? What findings would make you slow, pause or stop lengthening?
- 4. Risks and outcomes.** Which complications have you managed with this procedure? When discussing success, do you mean length gained, bone healing, function or avoiding further surgery?
- 5. Operations and recovery.** Which operations are planned, including hardware removal? What restrictions and assistance are likely at each stage?
- 6. Care and emergencies.** Who provides physiotherapy, imaging and urgent help? Who takes responsibility for follow-up if I return home or change clinics?
- 7. Time and costs.** What is included in the written estimate? What happens financially and practically if recovery takes longer or additional treatment is needed?
- 8. Expectations and wellbeing.** What support is available for realistic expectations, distress or difficulty coping with a long recovery? How much time can I take before deciding?

Take time to consider the answers. Before-and-after photographs and marketing claims cannot replace an examination, a clear treatment plan and informed consent.



## FURTHER READING

# Sources

General information checked on 16 October 2026. These sources support the educational explanations; they do not assess a reader or certify this guide. Guidance, device availability and regulatory status can change.

**1. International Center for Limb Lengthening**

[The limb lengthening process](#)

**2. Royal National Orthopaedic Hospital**

[External fixation for correction and lengthening](#)

**3. Royal National Orthopaedic Hospital**

[Lower limb lengthening with a PRECICE nail](#)

**4. US Food and Drug Administration**

[FITBONE TAA device description K203399](#)

**5. International Center for Limb Lengthening**

[Lengthening over a nail](#)

**6. Rozbruch and colleagues 2008**

[Limb lengthening and then insertion of an intramedullary nail](#)

**7. Hospital for Special Surgery**

[Stature lengthening surgery](#)

**8. NHS**

[Deep vein thrombosis](#)

**9. NHS**

[Compartment syndrome](#)

**10. Paley 2021**

[Four-segment lengthening in achondroplasia and hypochondroplasia](#)

**11. NHS**

[Pulmonary embolism](#)

## About this guide

Prepared by Lucas as a general introduction. It is not individual medical advice, a device manual or a substitute for consultation with an appropriately qualified clinician. Named systems are examples, not endorsements or a ranking.