



Limb Lengthening for increase of height

Lengthening of one short limb is now a successful and routine operation. Lengthening the limb entails not only lengthening of the bones but also the soft tissues like nerves, muscles, blood vessels; etc. Here lengthening does not merely denote stretching but actually consists of formation of new tissues. This is achieved by a Biological principle which was discovered by Prof. Ilizarov; a famous Russian scientist—under whom Dr. Milind Chaudhary, Director of CFIT India has had the privilege to train.

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This principle has been applied successfully at our institute and more than 700 limb lengthening operations have been successfully performed at the Centre for Ilizarov Techniques, Akola, India over the last 14 years.

Limb lengthening is done in both the lower limbs to increase height in Dwarfs. Dwarfs are unfortunate victims of diseases like Achondroplasia, Hypochondroplasia, Chondro-Ectodermal dysplasia, Turners Syndrome, etc. They are very short and disabled—day to day activities like reaching door handles, switches and basins; climbing into buses etc. become very difficult for them. They have strong motivation to be able to withstand the long procedure.

There is a scientific reason why they are better suited for this procedure. Their body composition is such that mostly the bones are short, but muscles, nerves and blood vessels have some reserve capacity built in which permits a lot of length to be achieved without complications! At our centre, dozens of such young people have achieved from 10 to 30 cm. of increase of height—without any permanent complications whatsoever. The same fact is not valid for normal people, however.

Can limb lengthening be done to increase height in short normal people?

This is the big question hundreds of young men and women from all over the world are asking our centre. The answer is **Yes!** However, it is not without **ifs and buts!**

It is indeed possible to increase your height using this scientific principle. Patients from USA, U.K., Malaysia, Singapore, Australia and Kuwait have undergone this operation at our centre and many more from all over the globe are about to begin.

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Our Centre is located in a campus with lush green surroundings with a quiet and peaceful atmosphere. Facilities for patients are modern and allow for a comfortable stay for as long as is needed. The Hospital is equipped with all modern equipment and care of high standards is maintained—comparable to anywhere in the world.

However, we choose to treat **less than 5%** of the patients who apply for treatment.

We will accept only those

- *who will understand the technique and its limitations.*
- *have modest & realistic expectations—usually no more than 1½ to 3½ inches of height.*
- *give themselves and us sufficient time—no less than 6 to 12 months.*
- *who have sufficient resources to make the treatment successful.*
- *rethink about the need to increase height to function better in life.*



11 cm of height achieved with Cross Lengthening

Though technically possible, this is a very involved project and needs strong determination on your part for it to succeed. This is unlike other cosmetic surgeries which last for only a few minutes or hours. This procedure lasts for several months.

The technical details of limb lengthening must be understood so that limitations of the method become clear and you know what to expect. Normal young people like you have a balanced body composition—unlike dwarfs—and hence can only gain modest amounts of height without creating any problems. That is why only till 1½ to 3½ inches—depending on which segments you choose to lengthen—can be safe without causing damage to joints or nerves and hence compromise function in future life.

If however you do have lots of time to spare, you may chose a strategy of Cross Lengthening (see page 4) which allows us to lengthen all 4 segments of the lower limbs—both the femurs and tibiae (thigh & shin bones) to allow you to get as much as 4 ½ inches as did this young man from USA.

Operative Technique

Lengthening is achieved with the help of an external fixator assembly which is inserted around the limb in an operation. This consists of thin stainless steel wires which are tensioned and attached to steel rings and other modular parts. This gives an excellent hold in the bone along with minimal intervention in the tissues. The modularity allows control of the bone in various dimensions over a period of time—all with minimal intervention of bodily tissues. It embodies the principle of Maximal gain with Minimal intervention!

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After application of the apparatus, the bone is cut in a special way—the operation is called a Corticotomy—with a small 5 mm incision in the skin. This makes sure that the thin covering of bone called the Periosteum nor the marrow which carries the blood vessels get damaged. This is done with a manual instrument and is a delicate operation and is crucial to the success of lengthening. This simulates a hairline fracture—the kind that heals really fast!

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Phases of Lengthening



The Lengthening is done in three phases. Immediately after operation is the phase of **Latency**. This allows the bodies' fracture repair mechanism to start functioning. This lasts 5 to 7 days. In **Distraction** the lengthening is done. The rate and rhythm are both important and usually $\frac{1}{4}$ mm is done at a time about 2 or 3 times a day. This is simple and can be done by the you. It is done with spanners or wrenches. A more sophisticated method, using an Automated Distractor can be used to achieve the same in a smoother manner. A weekly holiday is taken which ensures that the stretch is not too much. Daily Physiotherapy and exercises and walking allow almost normal function. Once the desired length is achieved, the apparatus is locked in place. In this phase of **Fixation**, the bone is allowed to harden inside. This phase usually permits more and more mobility and pain etc. is much lesser. Towards the end of this phase, weight bearing increases to almost full. Though the apparatus is on the limb, it does not pose many problems and pain is negligible. The hardening of the bone is slow and may take twice to three times as long as the Distraction phase.

DOUBLE LEVEL Lengthening

This is done if the desired length is more than 6 cm. The bone is cut at 2 levels. At each level lengthening is done at $\frac{1}{2}$ to $\frac{3}{4}$ mm per day. This decreases the duration by about 40%. The great benefit of this procedure is that it reduces the stretch on soft tissues like tendons and nerves. By reducing on the duration that the fixator is on the limb, stiffness of joints and other problems get minimized.



Double Corticotomy



Apparatus



Lengthening at 2 levels



Strategies of Lengthening

Depending on your age, amount of height that you want to achieve and the amount of time you can spare for it, various strategies may be used.

Centre for Ilizarov Techniques, AKOLA Both Legs Simultaneously

Bilateral Tibial Lengthening

This is the commonest strategy we use. In one stage both the legs, your shin bones (tibiae) are lengthened below the knees at a Single Level or at Two Levels. This is well tolerated by most patients and not too much help is needed in day to day activities. Walking is possible for a few minutes a day—albeit with little difficulty. Walking even for a short while helps improve blood circulation to the leg. This means faster healing times for the bone.

Cross Lengthening

When you desire more height, and are particular about bodily proportions; you can do lengthen the tibia as well as the femur. In the femur—thigh bone—it is wiser to expect a smaller amount like 3 to 5 cms. In one stage, we lengthen the femur on the Right side and the Tibia on the left side. Once this entire stage is over, then the Left femur and Right Tibia is lengthened. This ensures that in only two stages, all four segments in your lower limbs get lengthened.

The cross lengthening allows walking as well as positioning in bed. However, you have to be young and slim if lengthening is to be tolerable and trouble-free. A strong and determined personality is must for lengthening in the femur to succeed.



Bilateral (both sides) Femoral Lengthening

To consider lengthening both the thigh bones at the *same time* is usually possible only in very young children. We have safely done this till about the age of 10 years. Nursing in bed is difficult as well walking is cumbersome. This is the most difficult to tolerate and significant help from family members is necessary to make it possible. It may become more tolerable if you choose to do *one femur at a time* and then lengthen the other femur.

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Ipsilateral (same side) Femur & Tibia Lengthening

This is the strategy we employ the least as it places too much stress on tissues as well as creates a big difference in legs and needs a large shoe raise. The advantage is that you always have a good leg to bear full weight on and walk easily.

Bilateral Humeral Lengthening

This is needed if a lot of length has been achieved in the lower limbs and the bodily disproportion is very obvious. Generally recommended only in dwarfs.



II One Leg At A Time

This strategy allows you to carry on with life with the minimum disruption of normal routines and minimal discomfort and inconvenience. With bilateral tibia lengthening you are likely to find walking very difficult for many months. You would have to be in hospital and need a lot of help from a relative/friend or have a special nurse.

If you did only one leg at a time, walking will be easy because there is always one good leg to do it on. Looking after yourself, even doing a desk job will not be so difficult. You would be in hospital for no more than 10-15 days at the start and then come in for follow-up examinations. You could finish the treatment on one leg and only then start the other.

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Complications of Limb Lengthening

Limb Lengthening is a process which is fraught with risks and complications. Most of these are preventable as well as curable with proper supervision and timely intervention. Therefore hospitalization for the entire duration of treatment is mandatory. With experience of more than 1700 Ilizarov operations, we have a very low rate of permanent complications.

Pain & Discomfort

For most people the amount of pain and discomfort experienced during treatment is bearable. Severe pain is rare. Initial discomfort is felt only for a few days. Inconvenience during day to day activities is more common but is not intolerable.

Pin Track Infections

This is the commonest complication. With diligence and proper adherence to technique it can be kept to a minimum. Mild infections need daily dressings, moderate infections need re-tensioning of pins and oral antibiotics. Severe infections need local antibiotic injections and may need reinsertion of the pins—which may have to be done under Local or general Anesthesia. Pin Infections are the commonest cause of pain and this is usually temporary. In > 20,000 pins our rate of serious infection is less than 0.5%.

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Problems with Bone formation

The bone formation may be slow or poor. This is due to fixator instability or poor nutrition. New bone shows up late and matures very slowly. Improving stability of frame by adding rings or pins is needed. Rarely Bone Grafting may be needed. (only 2 times out of 700 in our experience).

Bone may form too quickly and densely. This may heal too fast and hence stop the lengthening. This needs a re-corticotomy under anesthesia or a much faster rate of lengthening—which in turn may cause pain.

The bone may bend due to severe muscular forces. A stronger frame, differential turning with application of hinges etc. can solve this problem. This usually needs modifications to the frame without anesthesia. Sometimes addition of pins under anesthesia may be needed as well.

Nerve Problems

Nerves may experience too much stress and stop functioning during lengthening. Daily supervision will ensure that this is caught in its earliest stages. By stopping the distraction the nerve may have a chance to completely recover. This has happened in 4 (out of 700) of our patients. Their nerves eventually completely recovered. Sometimes, the nerve may get kinked around a wire with progressive lengthening. An operation called as neurolysis may be needed to free it.

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Joint Problems

The stretch experienced by the limb segment is usually translated into the joint above or below. By lengthening the tibia, the ankle joint experiences maximum pressure. If one does not stop at a modest amount, this may cause stiffness of the ankle and may cause early arthritis within 10 or 20 years. The best policy is to perform only a modest amount of lengthening. This will ensure that the joints do not seize up. Rarely the knee or ankle may subluxate or dislocate during lengthening. Extending the frame below may help relocate the joint.

Depression

This is sometimes seen during the long treatment. The causes are usually underlying personal problems. Mostly, the long treatment and accumulation of small problems precipitates this. With medicines it can be treated.

Determination to see through the small problems will usually see you through this process. Having a friend or relative to see you through this process would be ideal and invaluable. However, most patients come for treatment alone. We do make arrangements for cooking as well as personal accompaniment for a few hours a day for help in activities of daily living.

Lengthening Over Nails

Lengthening over Nails is the new method developed in the USA about 10 years ago. This method decreases the duration of external fixation on the legs. It differs from the original Ilizarov by using sophisticated technology & more time in the Operation Theatre.

The Operation

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Initially we insert an Intramedullary Nail in the bone. The nail is inserted after significant reaming—widening of the marrow canal—to ensure smooth lengthening over the nail. This causes some blood loss and one may need a blood transfusion during or after surgery. The nail is locked at the upper end with locking screws and is kept free at the lower level. Then the bone is cut with a traditional corticotomy and the Ilizarov External Fixator is added from the outside. Due care is taken to ensure that the pins of the Ilizarov Fixator do not touch the Intramedullary Nail inside—checked using a C-ARM image intensifier. This will prevent chances of a superficial infection in the pin from reaching the nail and hence spreading all over the marrow canal. After surgery, too; due care has to be taken to ensure that pins remain free from infection and this needs longer supervision as well as prolonged dose of antibiotics.

Postoperative Care

Lengthening begins as usual after about 5-7 days. Lengthening is achieved with the Ilizarov fixator—usually at a higher rate than 1 mm per day. When the desired length is fully achieved, a second small operation is done in which the nail is locked using screws at the lower level. After securely locking it the external fixator is removed.



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Time factor

LON decreases the fixation mode of Lengthening . Instead of the fixator protecting the newly formed bone from outside, the nail does the same job from inside. Care needed remains the same and full weight bearing walking is not possible until full hardening of the bone. Walking may not be possible for the first few months. The total duration of treatment remains same—only duration of external fixation decreases by 40 to 50%.

Risks of LON

The biggest risk is of course infection. The infection may involve a smaller part or all of the bone marrow. It may show up during the lengthening or later during the fixation period or even after fixator removal. Treatment consists of long term antibiotics. After lengthening is over it may be necessary to remove the nail and ream (clean) the marrow cavity.

Lesser known but ever present risks are of course Pulmonary Embolism. This is very likely to occur due to the reaming during surgery or at a later date due to inexplicable reasons. Though the incidence is very low this is a dreaded complication in which the lungs get showered with bone marrow fragments arising from the lengthening zone. Its risks are lessened by venting the bone as well as by giving low dose heparin therapy in the beginning. Its treatment is supportive.

Less serious but more common complications include bending of the bone during lengthening. The nail may get jammed in the medullary cavity and hence the bone may not separate and lengthen. It may happen that bone may not form very well and bone grafting may need to be done. This can happen in about 5% cases.

Cost factor

The costs may go up significantly. The costs involved in surgery & the Operation theatre are much more—usually 2 to 2½ times. The costs of antibiotics increase dramatically. There may be some savings in hospitalization costs. A second surgery for locking the nail & removing the apparatus (a precision job) also adds to the cost.



Strategies of Lengthening Preparations for Surgery



Once you have finally decided to opt for surgery, it is best to start preparing in earnest. You need to get your weight under control if you are overweight. A good yardstick is to calculate your **Body Mass Index**. Divide your body weight in Kg. by the square of your height in cms. The resultant figure should be close to 25. If anything more you should think of reducing your weight.

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Start stretching and strengthening exercises. Your calf and hamstring muscles resist lengthening and need stretching. You should be able to bend over and touch your toes without bending your knees. You may also think of learning yoga and other exercise modalities which tend to make you supple.

Why Do it?

Finally, it is necessary for you to think about this aspect many times over. Why do limb lengthening at all? Could you not take the time and money and effort and put it in any other creative endeavour which would enrich your life?

Napoleon Bonaparte was hardly 5 foot tall. Shivaji Maharaj, the great Indian guerrilla warrior who became emperor in the 17th century was hardly 5'2" tall. The list of people who achieve great things despite a modest height is long. Because we are able to do the lengthening surgery does not mean we want to hardsell it.



If at all, after repeated thought you are motivated—our skill & experience will ensure that you get a good result.

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