Evaluation of Limb Lengthening Techniques

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INTRODUCTION

A major challenge to the orthopaedic research community is to improve the method of bone lengthening so that physicians can offer patients who need it a more effective option than those now available. The first step to improving any surgical method is to understand the advantages and limitations of techniques which have been used clinically. Since Codivilla (1905) first reported surgical lengthening of limbs, significant advances have been made in treatment of deficiencies resulting from trauma, infections, disease, and bilateral length disorders. Current treatment techniques include:

- Equalization by contralateral shortening;
- Orthotic management;
- Direct surgical lengthening;
- Periodic lengthening with an external device followed by bone grafting;
- Gradual osteogenic distraction with an external device;
- Gradual osteogenic distraction with an external device and intramedullary stabilization.

Many difficulties limit the success of each of these methods. Published clinical studies show a wide variety of complications reported with each technique. However, these complications can generally be classified in the following categories:
• Infection;
• Nerve or vascular injury;
• Severe pain;
• Transcutaneous pin loosening;
• Device failure;
• Hip or knee complications;
• Bone fracture after device removal;
• Bone malalignment or nonunion;
• Social and psychological complications;
• Expense.

In this chapter, the indications for lengthening are summarized and the principles of osteogenesis distraction are outlined, the current treatment techniques are described, the associated complications are discussed and the current development of implantable limb lengthening devices is reviewed.

CLINICAL INDICATIONS

The obvious indication for limb lengthening is the presence of a short limb. However, unlike other orthopaedic conditions that clearly require surgical intervention, short limbs do not necessarily need to be surgically lengthened to produce acceptable biomechanical function for the patient. Orthotics are commonly prescribed for patients with less severe discrepancies. Prosthetics are more feasible in cases were lengthening is prohibited or a substantial length deficiency exists.

Indications for lengthening of only one limb usually arise from congenital disorders, trauma, or bone loss as a result of severe infection. Bilateral lengthenings may be for patients with extreme achondroplasia or other dwarfism in which the affliction severely affects the patient’s ability to perform daily functions. Many factors influence the choice of treatment. These include the patient’s age when the condition is first evident, the growth pattern of the limb, whether the condition is progressive or stabilized, and the patient’s psychological and social situation.

Unilateral lengthening may be required after trauma or infection. The severity of open bone injuries is characterized by a rating system developed by Gustilo and Anderson (1976) and Gustilo and Mendoza (1984) and shown in Table 10.1. Open fractures are classified depending on soft tissue damage.