CHAPTER **11**

# TECHNIQUE GUIDE FOR LOCKING COMPRESSION PLATE

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## INTRODUCTION

Screws and plates provide the podiatric surgeon many options to fixate osteotomies, fusions, and fractures. They can be used for neutralization, dynamic compression, buttress, and antiglide. Their function depends on the placement of the plate and position of the screws. In the majority of foot and ankle surgery, traditional screws and plates achieve good results, however there are certain situations were traditional screws and plates do not provide optimal stability. These situations are when fixating osteoporotic bone, a comminuted fracture, or multiple fragments such as our diabetic patients with Charcot neuroarthropathy. So to improve stability in these particular situations, the use of an external fixator has been popularized in the past 10 years.

An external fixator enhances stability because unlike traditional screws and plates where all the components act independently from each other, when an external fixator is constructed all the components are locked together and form a ìsingle construct.î To enhance the stability of traditional screws and plates, this led to the development of an internal fixator, which like an external fixator, is a single construct; the Locking Compression Plate (LCP).[1,2] Two companies that produce LCP are Synthes and Darco International. Both companies have a variety of plates that can be used in various settings.

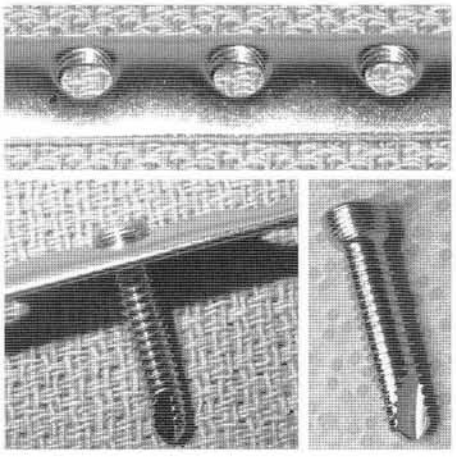

Figure 1. Locking compression plate.

What is unique about this system is that the plate has threaded plate holes, and the screws have corresponding threaded screw heads. When you insert the screw into the plate, the components lock together, and like an external fixator, forms a single construct (Figure 1). The LCP can be thought as being similar to an implantable external fixator. A study by Richter et al performed a biomechanical study comparing conventional and locking calcaneal plates and demonstrated that the locking plates provided greater stability during cyclic loading.[3] Both conventional screws and locking screws can be inserted in the locking plate. Thus, the LCP can be used in conventional plating techniques, locked plating techniques, or a combination of both. To use the LCP to achieve optimal fixation, one must understand the differences between conventional plating and locking plating techniques.

## CONVENTIONAL PLATING TECHNIQUE

To achieve anatomic reduction of osteotomies or fractures with conventional plating requires anatomic contouring of the plate to the bone (Figure 2). Interfragmentary compression can be achieved with conventional plating because a lag screw can be inserted in the plate at an angle. This allows the screw to be inserted perpendicular to the fracture line, fusion site, or osteotomy (Figure 3). Also, to achieve compression across transverse fractures, osteotomies, or fusions, screws can be eccentrically drilled. Because stability of the plate and bone relies on

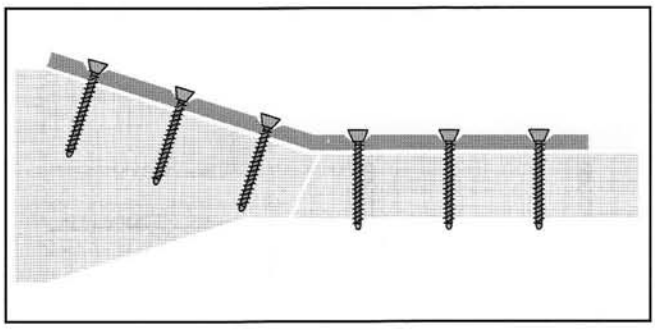

Figure 2. Conventional screw and plate requires anatomic contouring.

compression between the plate and bone, if the plate is not contoured to the bone, this results in loss of reduction. In conventional plating, the plate can be contoured in such a way so that when applying the plate against the bone, the results in reduction of the fracture. [4]

## LOCKED PLATING TECHNIQUE

When applying a LCP, the screws lock to the plate and form a single fixed angle construct. When the screws lock into the plate, no further tightening can occur. Hence, the plate locks the bone segments in their relative positions. Therefore, it is necessary to perform anatomic reduction before applying the LCP (Figure 4). Interfragmentary compression cannot be performed with locking screws because the screws must be inserted 90 degrees to the plate. The locking screws also cannot be inserted eccentrically into the plate because the locking screw must be inserted exactly in the center of the hole in order for the screw to lock in the plate.

In theory, the stability of the LCP does not rely on the compression between the plate and bone; therefore, contouring of the plate to the bone is not necessary. However, to minimize the gap between the plate and bone, and to reduce the prominence of the LCP, the plate can be contoured. Haug et al investigated the effects of plate contouring between conventional and locked plates and demonstrated that the stability of the locked plate is not dependent on the precise anatomic contouring of the plate.[5]

## COMBINATION INTERNAL FIXATION

The LCP is designed to accept both conventional screws and locking screws. In order to perform combined internal fixation, there are general guidelines that must be followed. First, the fracture, osteotomy, or fusion site must be stabilized using conventional screws. The LCP can be contoured to aid in the reduction of the fracture; however when bending the plate, it is important to use the threaded plate holders on two consecutive holes. This ensures that the threaded holes will not be distorted. If the holes are distorted, the locking screws cannot engage into the plate properly.

When applying the LCP, a conventional screw or locking screw can be inserted first. When a conventional screw is inserted first, this pulls the plate to the bone. If a locking screw is inserted first, it is important to secure the plate to the bone. This can performed with a bone clamp or the Whirly Bird (Threaded Plate Holder). When using the Whirly Bird, it is recommended not to insert the device in a hole that will be immediately involved in the plate fixation.

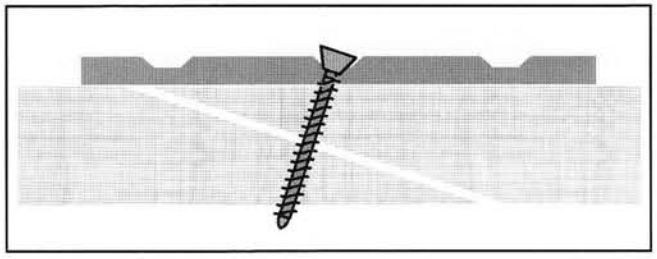

Figure 3. Interfragmentary compression.

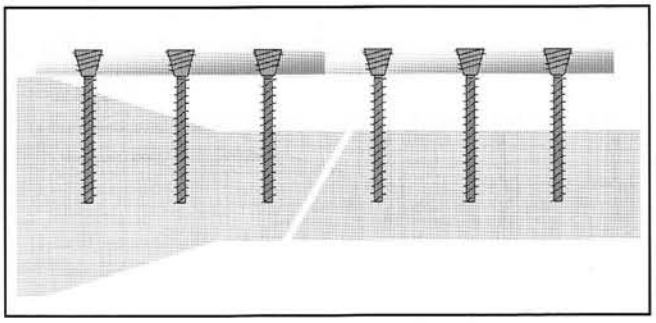

Figure 4. Anatomic reduction is required before application of Locking Compression Plate.

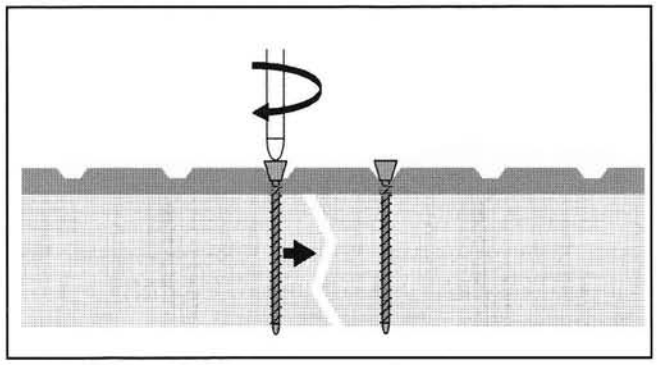

Figure 5. Dynamic compression.

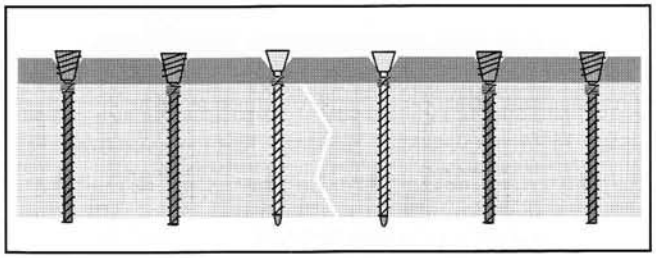

Figure 6. Optimal stability requires a minimum of 2 bicortical locking screws on each segment.

When the Locking Plate is used for dynamic compression, the first screw inserted can be either a conventional or locked screw. The second screw must be a conventional screw (Figure 5). [6] For optimal stability, it is recommended to capture a minimum of 4 cortices on either side of the fracture. Therefore, a minimum of 2 bicortical locking screws must be inserted across either side of the fracture (Figure 6). [4,7]

## SUMMARY

The LCP is an internal fixator that enhances plate osteosynthesis (Figure 7). Both conventional and locked screws can be inserted into the plate. It is important to understand both conventional plating techniques and locking plate techniques in order to optimize the application of the LCP.

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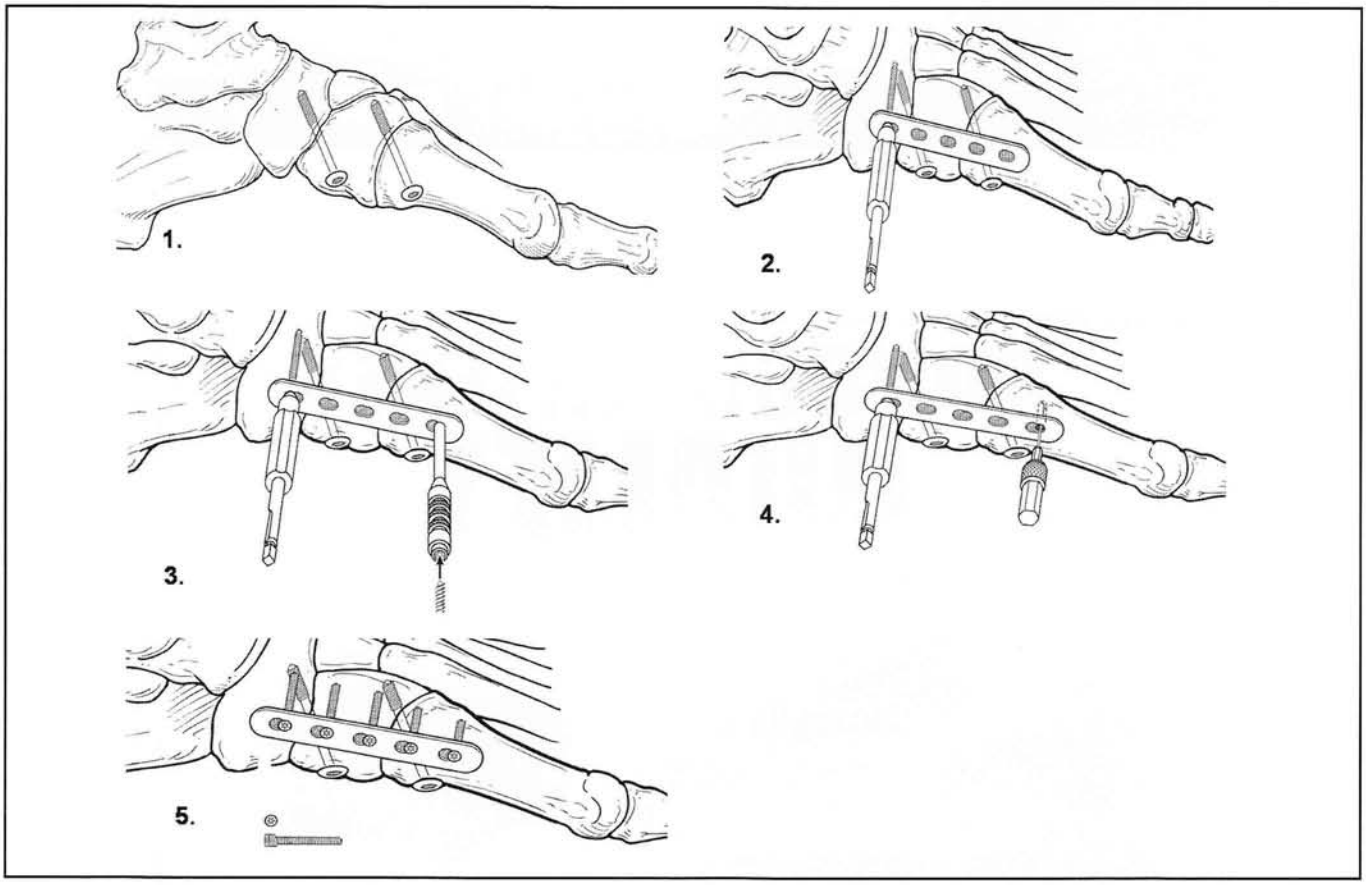


Figure 7. Application of Locking Compression Plate
The following are the steps for application of the Locking Compression Plate

1. Perform reduction of fracture, osteotomy, or fusion site
2. Stabilize plate to bone using:
   a. Bone clamp
   b. Whirly Bird (Threaded Plate Holder)
   c. 4.0mm or 3.5mm Cortex/Cancellous Screw
3. Inserted Threaded Drill Guide and Pre-Drill with 2.8mm drill bit
4. Remove Threaded Drill Guide and Measure with Depth gauge
5. Insert 3.5mm Locking Screw with Star Head Screw Driver
6. Repeat Steps 3-7 for additional screws