CHAPTER **4**

USE OF A 1.5mm HAND FRACTURE LOCKING PLATE SYSTEM FOR LESSER METATARSAL PATHOLOGY

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INTRODUCTION

Repair of lesser metatarsal fractures and osteotomies can pose difficulties due to the close proximity of the metatarsals, the anatomic positioning overlying structures, the thin periosteal layer that is desired to be preserved, and the basic construct of the lesser metatarsals including the narrow width and the dorsal crest. Repair can often seem awkward while fixation options are limited and the plating systems are, at times, bulky and poorly contoured to the metatarsals. The bulkiness of these systems can create significant difficulty when trying to preserve and repair the periosteal layer, which is vital to the vascularity and subsequent healing of the metatarsal itself. With the advent of the 1.5 mm locking plate system (A.L.P.S.; anatomic locking plate system) from the DePuy hand fracture set, these factors become less of a challenge because the plate is very low profile and was initially designed for the small bones of the hands, including the metacarpals, which are very similar in anatomy to the metatarsals. This system has multiple uses in the lower extremity including fractures, joint fusions, reconstructions, and especially in osteoporotic bone.

THE HAND FRACTURE SYSTEM

The A.L.P.S. hand fracture system is a low profile titanium system and utilizes a multiplanar locking screw technology. The contoured plates essentially hug the anatomy and come in 5 plate styles including straight, Y, T, web, and T/Y and include 1.5 mm and 2.5 mm screw systems (Figure 1). The system utilizes self-tapping cobalt chrome screws for strong stable fixation. The screws for the 1.5 mm plate include 1.5 mm locking cortical, 1.3 mm non-locking cortical, and 1.5 mm non-locking cortical at lengths 8-24mm. The F.A.S.T. (fixed angle screw targeting guides) allow precise drilling and placement of the screws with guides that are preloaded and disposable, which result in a faster thus more effective application (Figure 2). The system includes locking, variable angle, and standard screws. The A.L.P.S. plating system is meant to allow a multiplanar correction of very small, difficult fractures and osteotomies with a more contoured profile than previously introduced plating systems. The depth of the DePuy 1.5 mm locking plate is a mere 1.1 mm

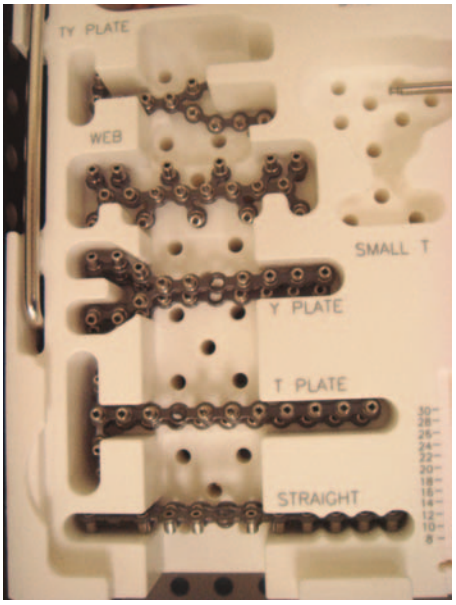

Figure 1.

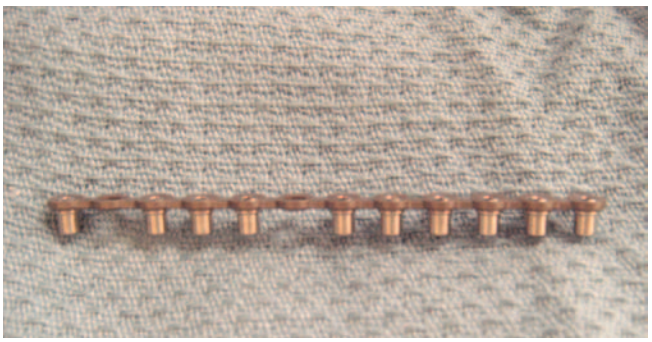

Figure 2.

and provides 0.75 mm of compression per hole. The set includes: soft tissue guide, screw pickup, plate holder, depth gauge, plate benders, Kirschner-wire reduction clamp, small reduction clamps, cutting pliers, elevator, MQC handles, and retractors.

A disadvantage of the A.L.P.S. hand fracture system is the lack of the "Combi hole" seen in the Synthes LCP system, which allows the user to choose between a locking or non-locking lag screw for each hole. This allows more versatility when attempting the create compression at various positions within the plate due to the "off-setting

compression screw" principle. A variation of the "offset compression screw" principle can be found with the multi-directional thread peg (MDTP). The locking multi-directional screws allow for angulation from a fixed angle axis (20 degrees). When using the MDTP, a 2.0 mm drill is used through the soft tissue guide for the 2.5 mm MDTP or the 1.1 mm drill for the 1.5 mm locking screw. The limitation of this system is that the off-axis angle is recommended at an angle of no greater than 10 degrees off center (20 degree cone).

The A.L.P.S hand fracture system is color-coded (Silver=1.5 mm, Gold=2.5 mm) to allow easy use of the system. The plate can be easily cut or bent. The plate is easy to bend and contour while maintaining its strength due to the fact that it is made of low-profile titanium. When shortening the plate, use of the plate benders allows breakage of the plate when bent greater than 90 degrees and creates a small lip of the plate that adds the benefit of biting into the bone if bent in a downward direction. This can allow the plate to grab onto the bone in a more effective manor and adds better purchase of the plate. This also ensures that the plate does not agitate the overlying soft tissues. When applying the plate, if the plate does not fit closely to the bone, first insert one of the cobalt chrome non-locking screws to help suck down the plate. Then insert the locking screws into the remaining holes. Once all the screws have been inserted, a locking screw can then replace the initial non-locking screw to allow a more stable construct. Due to the plate's low profile, it is excellent for areas of less soft tissue coverage such as the fifth metatarsal.

An advantage of the system is the screw driver. When inserting a locking screw, the screwdriver has a "weak spot" in the shaft of the driver that will break if too much torque is placed on the driver. This prevents a cold weld of the screw to the plate, which is not desired.

The Y-plate is pre-contoured to go around tendon insertion. This plate is very effective for fifth metatarsal base fractures as the "Y" portion of the plate can be applied as to not obstruct the insertion of peroneus brevis. When a fracture has resulted in a gap in the bone due to comminution of the fracture fragments, the plate can be used to stabilize the fracture fragment acting as a buttress plate, which is more stable than a conventional non-locking plate. This is particularly useful at the fifth metatarsal base where soft tissue coverage is very thin, in most cases. Due to the ease of application, thin profile, and versatility, the A.L.P.S. hand fracture 1.5 mm plating system has proven to be an asset for lesser metatarsal pathology including fractures and arthrodeses especially with osteoporotic bone.

CASE 1

The patient was a 52-year-old woman with chronic bunion and sub-second metatarsal pain with a large callus due to a plantarflexed, elongated second ray (Figure 3). She had failed conservative therapy including padding and orthotic management. Her medical history included hypertension. The planned procedure included Austin McBride bunionectomy with Weil osteotomy of the second metatarsal. Fixation for the bunionectomy included two 2.5 mm screws from the A.L.P.S hand fracture set (Figure 4). The second metatarsal osteotomy was fixated utilizing a 3-hole straight plate from the 1.5 mm A.L.P.S. hand fracture plating system (Figures 5, 6). The patient was then 6 weeks nonweight bearing in a below-knee cast.

Figure 3.

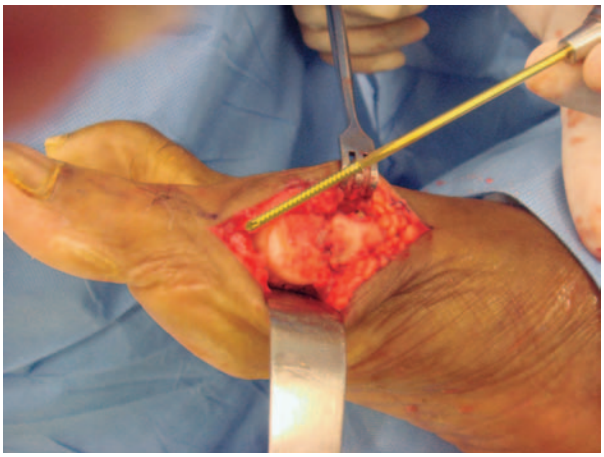

Figure 4.

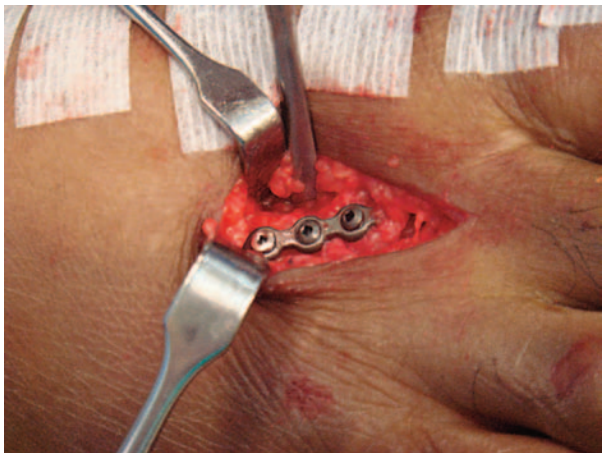

Figure 5.

Figure 6.

CASE 2

The patient was a 33-year-old man with a comminuted fifth metatarsal base fracture that occurred when he was playing basketball. The proximal fracture fragment had retracted laterally to the cuboid. The central portion of the fracture was comminuted severely enough that the proximal fragment was unable to be adequately approximated to the metatarsal and left a gap between the fragment segments. At this point, a buttress-type plating application was necessary. The 1.5 mm A.L.P.S hand fracture set straight plate was utilized. Once fixation was applied and restoration of the fifth metatarsal length was accomplished, the gap was filled with DBM bone putty (Figures 7, 8). The patient was then 6 weeks nonweight bearing in a below the knee cast.

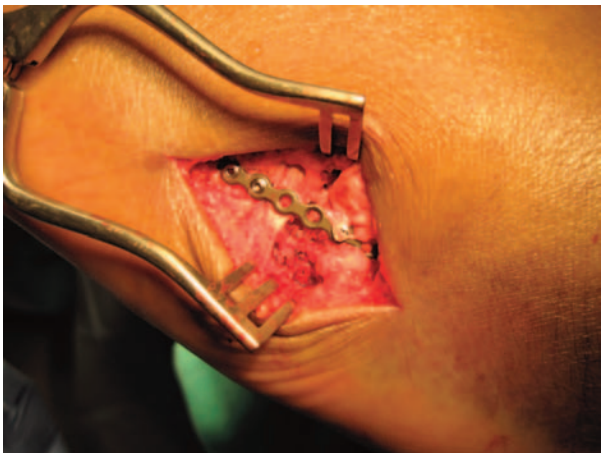

Figure 7.

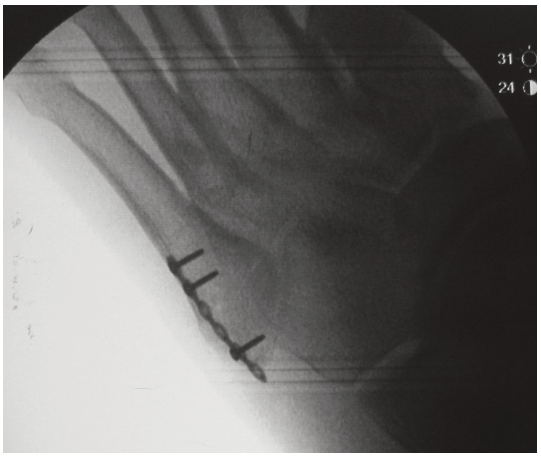

Figure 8.

Figure 9.

Figure 10.

CASE 3

The patient was a 48-year-old woman who presented with fourth and fifth metatarsal fractures that occurred when she fell down her stairs (Figure 9). The fourth metatarsal was fixated with a one-quarter tubular locking plate from the Synthes small fragment locking plating system. The fifth metatarsal fracture was fixated utilizing a straight plate from the 1.5 mm A.L.P.S. hand fracture plating system (Figure 10). The A.L.P.S. plate was very beneficial at this site as the patient was very thin and therefore had thin soft tissue overlying the fifth metatarsal. Following surgery, the patient was placed in a below-knee cast for 6 weeks.