CHAPTER **50**

Cannulated Screw Fixation

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While cannulated screw fixation is not a new addition to the science of internal fixation, it has enjoyed an increase in popularity in recent years. Among the claims made for cannulated screw fixation are increased speed and ease of fixation. Probably the greatest advantage lies in the exact placement of fixation over the guide pin, the position of which can easily be evaluated radiographically.

Several new systems and adaptations of older systems are available as cannulated sets. These include the Ace Alpha-tec and Barouk systems. In addition, the Herbert and Accu-trak sets fill the need for dual-pitch applications with the advantage of being cannulated systems.

All of the previously-mentioned systems provide cannulated screw fixation with the use of titanium alloy implants. Titanium provides increased strength of the fixation devices, while allowing for a decrease in the amount of material used in construction when compared to stainless steel counterparts.

The cannulated screw also merits increased resistance to bending due to its design. The tubular design of a cannulated screw effectively mimics an I-beam. Basic engineering principles can be used to show that an I-beam, or likewise a cannulated screw, of a given mass is stronger than the corresponding solid configuration structure. By combining the use of a stronger material with the structural advantages of a cannulated screw, fixation is achieved without loss of bending or torsional strength.

APPLICATIONS

One of the best applications of cannulated screw fixation is in a fracture or osteotomy configuration where the tip of the screw will not be observed. By definition, this primarily applies to cancellous screw applications such as subtalar and metatarsal-cuneiform arthrodesis. In these applications, placement of the guide pin serves both for radiographic evaluation of position and temporary fixation, especially in areas with limited space availability. Within cancellous bone, a properly placed guide pin will maintain stability until placement of the screw, an advantage which is lost when these screws are applied to transcortical applications. The exception to this would be with a true self-cutting and self-tapping screw. Although there are systems on the market that make this claim, it is interesting to note that these companies still recommend predrilling to avoid splitting of the cortex. This step causes loss of purchase of the guide pin, leaving a useless, non-functional pin in the now unstabilized osteotomy or arthrodesis site.

An additional drawback to self-drilling and self-tapping screws, is the loss of the fine tactile sensation of screw tightening, which is especially necessary for smaller screws. By the nature of design of a self-cutting, and to some degree a self-tapping screw, force must be applied to advance the screw, thus the fine tactile sensation of screw purchase is lost. From this description, one can see that for transcortical fixation, there are few, if any, advantages to the use of cannulated screws.

Other examples where cannulated screws may be appropriately used include the medial malleolar fracture, and fixation of joint-depression type calcaneal fractures. Both of these situations require reduction and fixation with difficult or incomplete visualization of fracture lines and joint surfaces.

The full benefit of cannulated screw fixation may be realized when pin placement is performed under fluoroscopic guidance. In addition to speeding the surgery by yielding immediate confirmation of pin placement, the surgeon is able to directly visualize drilling and tapping. Fluoroscopic guidance also aids in maintaining the stability of the guide pin by preventing overzealous drilling, which can lead to destabilization of the guide pin.

CLINICALLY ILLUSTRATED TECHNIQUE
Placement of the Synthes 7.0 mm Cannulated Screw

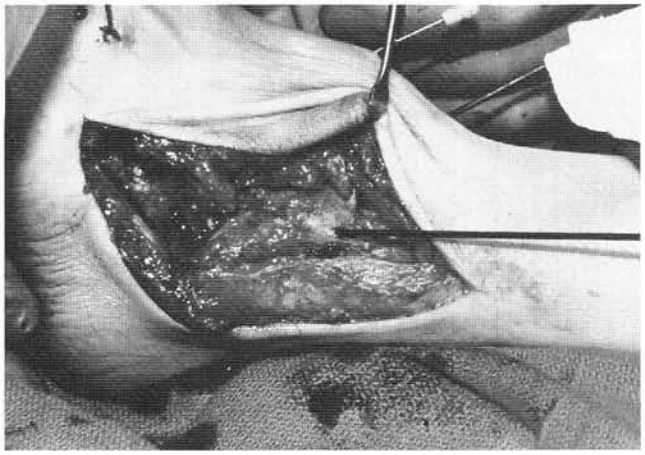

Figure 1. Temporary fixation prior to screw placement is accomplished with the guide pin from the cannulated screw set. Here the guide pin is seen placed for temporary fixation of an ankle fusion.

Figure 2. A 4.5 mm cannulated drill is used over the guide pin to establish a channel for the core of the screw. Drilling is best performed under C-arm guidance to protect stability of the guide pin.

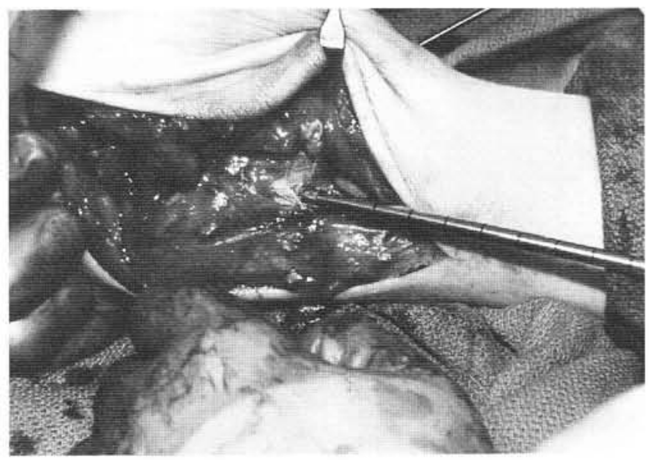

Figure 3. After the depth gauge is used, the hole is tapped to the appropriate depth as measured on the tap shaft, and observed under fluroscopic imaging. No countersink is used due to the lower profile of the cannulated screw head.

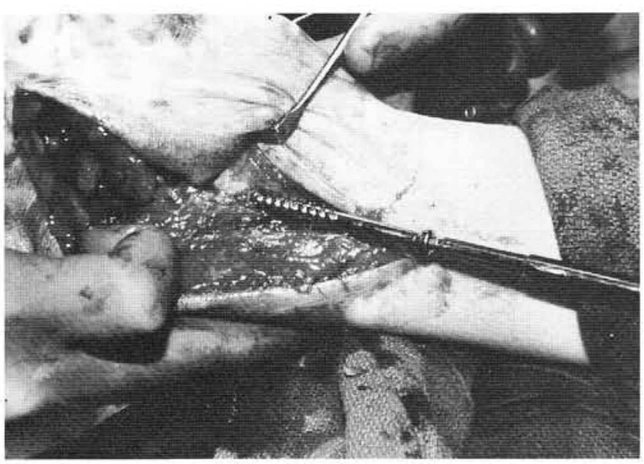

Figure 4. The screw is then introduced over the guide pin and tightened using the cannulated screw driver.

Figure 5. After the removal of the guide pin, final tightening of the screw is performed.

DISADVANTAGES OF CANNULATED SCREW FIXATION

Although cannulated screws do have advantages for certain applications there are disadvantages as well, as can be found in any form of fixation with critical evaluation. The first drawback that the surgeon may notice, with evaluation of the cannulated screw, is that the core diameter of the screw is slightly increased in order to accommodate the guide pin. This leads to a slightly diminished thread diameter to core diameter ratio, and could potentially decrease the pull-out strength of the screw due to the decreased surface area of the threads (Fig. 6).

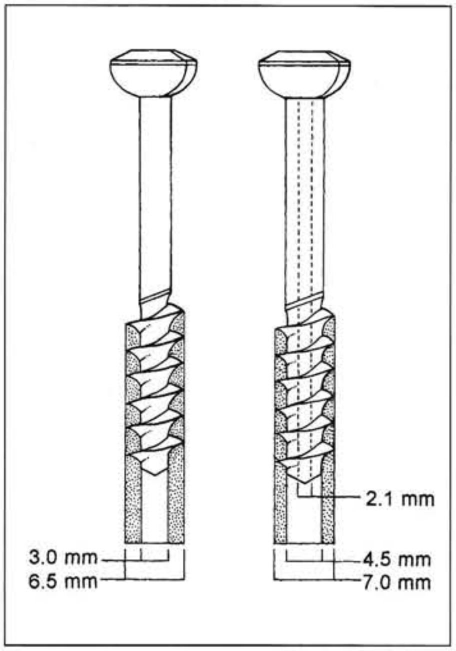

Figure 6. A comparison of a standard screw (left) and a cannulated screw (right). Note the wider core diameter and the decreased thread excursion from the core of the cannulated screw.

In addition to the lower thread profile generated by the increased core diameter, there may be further flattening of the thread profile upon insertion of the screws. This is mainly observed with the softer titanium alloy implants, and is magnified in systems which are self-drilling and/or self-tapping, such as the Ace cannulated screw system. In the author's experience, these screws are useless and must be replaced if any redirection or replacement of the screw is required (thus also increasing the cost). This problem has not been observed with the stainless systems, such as the ones produced by Synthes.

Cannulated screws are also more expensive than standard screws, with approximately 8-10 times the cost of standard screws, based on comparison with standard small and large fragment Synthes screws. In addition to the per-screw charge, one should also consider that if a titanium set is utilized, there is also the potential need to replace a malpositioned screw, again increasing the cost burden.

SUMMARY

Cannulated screws may be used advantageously in areas of blind fixation such as the triple arthrodesis, LisFranc arthrodesis, or calcaneal fracture. The increased cost of the implants and the difference in thread pattern should be considered, and the application limited to appropriate cases where the benefit of increased speed and precision of screw placement outweighs the cost burden.

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