

DIGITAL ARTHRODESIS USING THE STAYFUSE INTER-DIGITAL FUSION DEVICE

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Many techniques have been used in the correction of digital deformities. History has taught us that the stabilization of the digit, whether it be via arthroplasty and tendon balancing or arthrodesis, can provide long-term relief of digital contractures. Interphalangeal joint arthrodesis has been shown to provide better stability and planal correction than arthroplasty techniques. Many types of implants and arthrodesis techniques have been utilized including monofilament wire, Kirschner wires, various screws, absorbable fixation and the use of allogenic bone pins. Techniques which leave an external form of fixation may create complications secondary to pin tract infections or pistoning and promote apprehension for the patient who is concerned regarding removal of the pin. The use of the StayFuse Inter-digital Fusion Device is another alternative in the stabilization of digits via arthrodesis and affords many benefits including the lack of external fixation and early mobilization.

DESIGN OF STAYFUSE INTER-DIGITAL FUSION DEVICE

The StayFuse Inter-digital Fusion Device is a two-component titanium implant that is manufactured by Pioneer Surgical Technology (Marquette, MI), and is distributed by Zimmer, Inc. (Warsaw, IN) (Figures 1, 2). This unique design allows it to be inserted into the two osseous fragments and then be ratcheted together allowing apposition of the osseous surfaces. This is performed without the need to violate the adjacent joints as has been done with prior attempts at screw fixation of digital arthrodesis. The hexagonal shaped interface eliminates rotation in the frontal plane while the inserted "ratchet" component

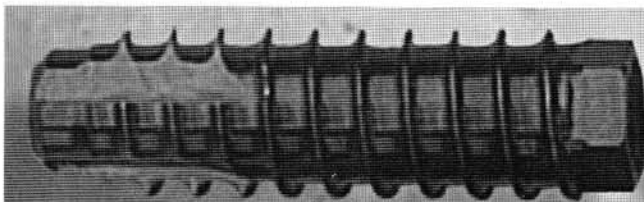


Figure 1. The PROX (proximal phalangeal) component of the StayFuse Inter-Digital Fusion Device system.

provides both sagittal and transverse plane stability. The tri-plane stability allows for limitation of motion at the arthrodesis site and maintenance of intra-operative correction. This internal stability allows this device to also be beneficial in the treatment of phalangeal fractures.

The color coded instrumentation and various sizes makes the implantation sequence user friendly and allows its use in bones of various sizes (Table 1, Figure 3). Size determination is evaluated pre-operatively with templates with final determination made intra-operatively based on visualization of phalangeal diameter and length. Appropriate preoperative evaluation and intra-operative technique for osseous preparation allow the appropriate insertion of the implant and early mobilization without the risk for pin tract infections or pistoning that may occur with other fixation techniques.

Caution must be used with the use of the implant in osteopenic bone. The use of the implant is contraindicated in the presence of infection or in children due to the potential damage of the growth plate.

SURGICAL TECHNIQUE

The digit is prepared via the techniques of anatomic dissection to allow adequate visualization of the Proximal interphalangeal joint (PIPJ). Attention is directed to the PIPJ and the cartilaginous surface is resected with hand or power instrumentation of both the proximal phalanx head and the base of the intermediate phalanx. The color coded drill bit is then inserted by hand with the use of a Kirchner wire beneficial to pre-drill and establish the desired alignment. Based on the dimensions of the proximal phalanx the Proximal (PROX) female portion of

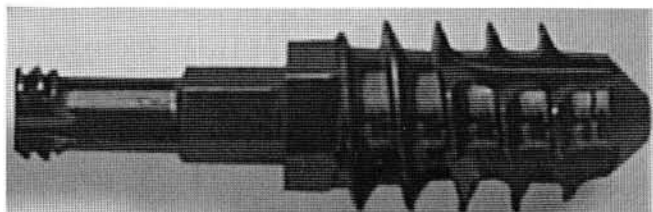


Figure 2. The MID (intermediate phalangeal) component of the StayFuse Inter-Digital Fusion Device system.



Figure 3. Color coded drill bits of various lengths and diameters are used to drill pilot holes based on the size of implant desired.

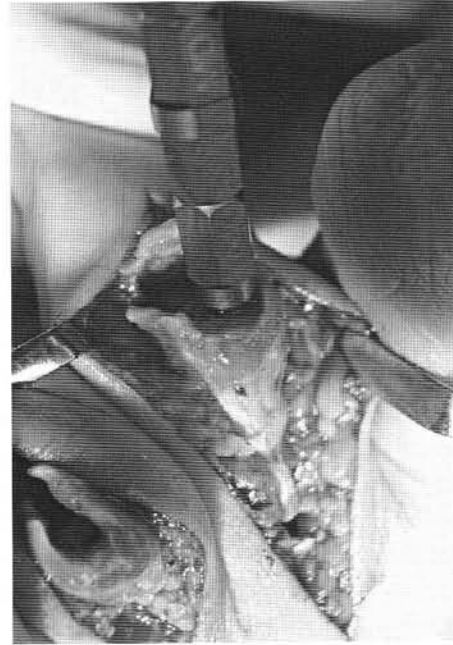


Figure 4. Intraoperative illustration of drilling the pilot hole for the proximal phalangeal (PROX) component.

Table 1

**STAYFUSE INTER-DIGITAL FUSION
DEVICE SIZE REFERENCE**

<i>Drill Color</i>	<i>Hex Size</i>	<i>PROX Component</i>	<i>MID Component</i>
Blue	2.5 mm	2.8 mm	3.8 mm x 6 mm 4.3 mm x 6 mm
Grey	3.0 mm	3.3 mm	3.8 mm x 6 mm
			4.3 mm x 6 mm
			5.0 mm x 6mm
			5.0 mm x 5 mm
			3.8 mm x 6 mm
	3.0 mm	3.8 mm	4.3 mm x 6 mm 5.0 mm x 6mm 5.0 mm x 5 mm

the implant is inserted into the proximal phalanx. The Middle (MID) male portion of the implant is then inserted into the base of the intermediate phalanx. Care must be taken to insert the components parallel to the axis of the bone to allow rectus alignment of the digit in both sagittal and transverse planes. Both portions are visualized for appropriate alignment parallel to the long axis of the respective phalanges. The hexagonal head allows tightening of the implant flush with the resected bone surface. Attempts are made to ensure sagittal alignment of the MID component arms and that the hexagonal components will align with appropriate frontal

plane rotation. The components are then fit together end to end with compression applied resulting in a “snapping” motion with the ratchet-like arms of the MID portion engaging the PROX portion. The hexagonal base is aligned and completion of the insertion with osseous and implant apposition achieved. The inserted implant’s position may then be verified with radiographic studies. Adjunctive soft tissue release is performed in a systematic manner prior to implant insertion as deemed necessary based on pathology at the metatarsophalangeal joint. The wound is closed in a layered fashion (Figures 4-8).

In the event the device must be removed for any reason, intra-operatively or post-operatively, unsnapping the device is not possible. Removal is performed by creating a window in the dorsal cortex of the intermediate phalanx. Removal of this window allows exposure to the MID component of the device which has been ratcheted together and is removed with rotation of the device in a counterclockwise direction.

Postoperative management involves a sterile dressing with ambulation with a surgical shoe. Serial radiographs are reviewed to confirm implant placement and healing of the arthrodesis site. Showering is advanced based on wound progression and return to athletic shoe gear is advanced as tolerated. Return to activity is based on physician preference.

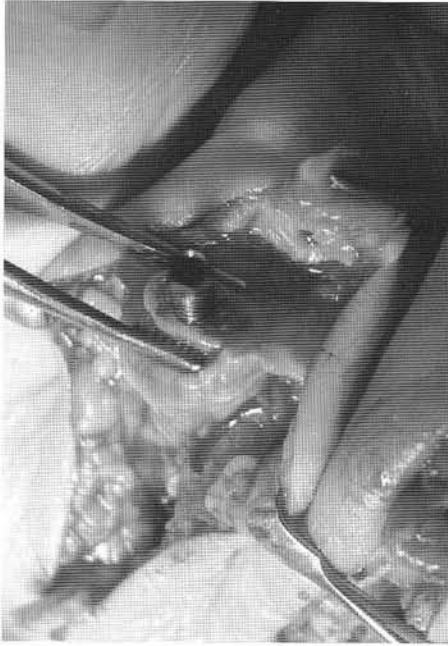


Figure 5. Partial insertion of the proximal phalangeal (PROX) component.



Figure 6. Insertion of the proximal phalangeal (PROX) and intermediate phalangeal (MID) components flush with the osseous surface.

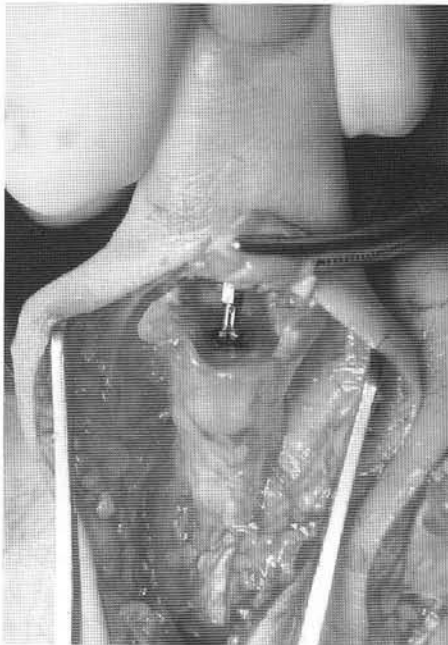


Figure 7. Technique for insertion of the intermediate phalangeal component (MID) into the proximal phalangeal component (PROX) with arms parallel to sagittal plane.

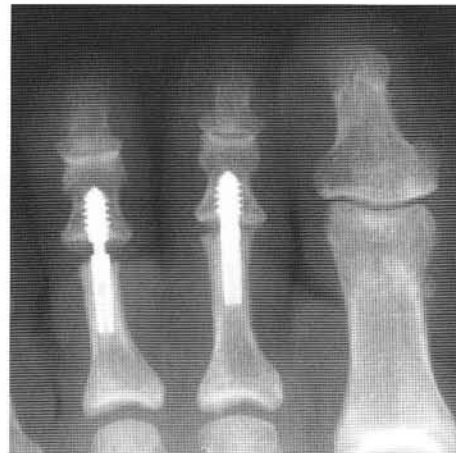


Figure 8. Radiographic assessment of StayFuse interdigital implant before (left) and after (right) completion of insertion and "ratcheting" together of implant components.

SUMMARY

Interphalangeal arthrodesis has proven to be a reliable modality in the treatment of hammertoe deformities. The use of the StayFuse Inter-digital Fusion Device for digital arthrodesis gives the surgeon the ability to achieve triplane stability while allowing for early mobilization and preventing the need for external wire fixation.