

extremities solutions



SURGICAL TECHNIQUE

WRIGHT.

EVOLVE[®]
Radial Head Plate

EVOLVE® Radial Head Plate
surgical technique

as described by
JOHN T. CAPO, MD
VIRAK TAN, MD

Proper surgical procedures and techniques are the responsibility of the medical professional. The following guidelines are furnished for information purposes only. Each surgeon must evaluate the appropriateness of the procedures based on his or her personal medical training and experience. Prior to use of the system, the surgeon should refer to the product package insert for complete warnings, precautions, indications, contraindications and adverse effects. Package inserts are also available by contacting Wright Medical Technology, Inc.

EVOLVE®

Radial Head Plate

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GENERAL PRECAUTIONS

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DEVICE DESCRIPTION

The Evolve® Radial Head Plate is a low-profile device designed for secure, fixed-angle fixation of radial head fractures. The fixed-angle locking screws are designed to provide buttressing support of the radial head, even in the presence of limited comminution.

All implant components are manufactured from surgical-grade Stainless Steel for maximum strength and fatigue life. The outer surface is highly polished to resist adhesion to the overlying soft tissue structures.

INDICATIONS

Operative exposure of the fracture becomes necessary if acceptable reduction cannot be achieved by closed means or in those high-energy injuries in which extensive soft tissue or associated skeletal injury requires stable fixation of the radial head.

There are several fracture types that may require open reduction and internal fixation:

- Comminuted radial head fractures with good bone stock and adequate fracture size.
- Intra-articular radial head fractures with significant displacement.
- Radial neck fracture with significant angulation or displacement.
- Unstable elbow fracture dislocations with Lateral and Medial Collateral Ligament injuries.

CONTRAINDICATIONS

Contraindications may include, but are not limited to the following:

- Severe comminution with lack of adequate fracture size
- Severe medical illnesses
- Patient unreliability
- Localized septic process
- Massive soft tissue swelling
- Lack of basic equipment
- Unfamiliarity with the surgical approaches





FIGURE 1 |



FIGURE 2 |

PREOPERATIVE PLANNING

Radiographs of both the injured and contralateral non-injured limbs can be helpful with pre-operative surgical planning.

In many circumstances, it is difficult to determine pre-operatively whether ORIF of the radial head will be feasible. In the event that the fracture pattern does not permit adequate fixation of fragments, the surgeon should be prepared to replace the radial head with an implant such as the Evolve® Radial Head Prosthesis. Clinical studies have demonstrated the benefits of radial head replacement over resection, including preservation of the radial length and maintenance of elbow valgus stability.^{1,2,3}

SURGICAL TECHNIQUE

STEP 1 - PATIENT PREPARATION

A modified Kocher approach is the preferred exposure for plating of the radial head. Complex elbow fractures or dislocations may dictate the use of an alternate exposure.

For the modified Kocher approach, the patient is placed in a supine position and the injured arm supported by a hand table. The initial incision is made through the distal portion of the lateral column | **FIGURE 1**. Once skin flaps have been raised, the lateral supracondylar ridge of the distal humerus is identified | **FIGURE 2**.

Dissection is performed through the common extensor mass onto the joint capsule, staying anterior to the mid-axis of the radial head to avoid disruption of the Lateral Ulnar Collateral Ligament (LUCL). The supinator muscle is then visualized and its proximal fibers are divided. If an extended exposure is necessary (i.e. greater than 3.5cm distal to the radiocapitellar joint line), the posterior interosseous nerve should be identified in the supinator muscle.

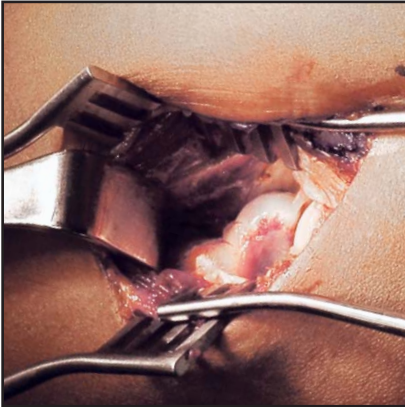


FIGURE 3 |

The lateral joint line is exposed by dividing the capsule longitudinally across the annular ligament, in line with the superficial dissection and anterior to the LUCL complex. | **FIGURE 3**

STEP 2 - IMPLANT SIZING

The Evolve® Radial Head Plate sizes correspond with the most commonly used Evolve® Prosthesis head diameters | **FIGURE 4.**

FIGURE 4 |

Radial Head Plate Size	Corresponding Evolve® Prosthesis Head Diameter (mm)
1	20
2	22
3	24
4	26



FIGURE 5 |

The correctly sized plate will conform closely to the underlying bone of the reconstructed radial head | **FIGURE 5.**

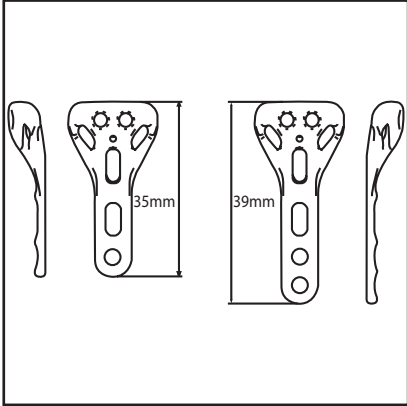


FIGURE 6 |

There are also long and short versions of each plate | **FIGURE 6**. The short plate is appropriate for most fractures and allows for a smaller exposure; however, the longer plates are appropriate for fractures with more extensive neck and shaft involvement.

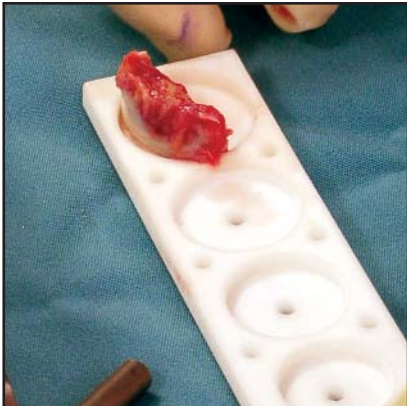


FIGURE 7 |

Large, free fragments of the radial head may be removed from the surgical site and used to determine the correct plate size with the sizing tray (P/N 2490-3000) | **FIGURE 7**.



FIGURE 8 |

Alternatively, if the surgeon prefers not to remove fragments from the surgical site, the plate size may be determined with the *in-situ* sizers (P/N 2490-3102 and 2490-3304) | **FIGURE 8**.



FIGURE 9 |

STEP 3 - REDUCTION AND PLATE POSITIONING

In most cases, the precontoured plate will not need to be bent. If necessary, fine adjustments in plate contour may be performed with the Plate Benders (P/N 2490-0100 and 2490-0101) | **FIGURE 9**. However, do not exceed 10 degrees of bending, and bend in one direction only.

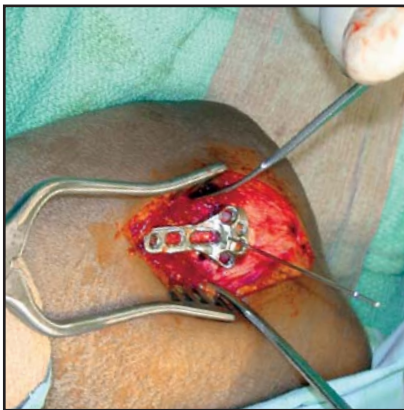


FIGURE 10 |

If fragments can be reduced directly, the Evolve® plate may be applied directly to the radius and provisionally fixed with a 0.045" K-wire (P/N 2490-0090) | **FIGURE 10**. The plate should be placed directly opposite the Proximal Radial Ulnar Joint (PRUJ). This position is directly lateral with the forearm in neutral rotation. It is imperative that the plate be placed within the “safe zone” of the PRUJ so it does not impede forearm rotation. This zone is in line with Lister’s Tubercle, on the direct dorsal surface of the radius.



FIGURE 11 |

If the fragments cannot be reduced *in-situ* in a stable fashion, they may be removed and reassembled on the back table using the sizing tray, K-wires and the Evolve® plate. | **FIGURE 11**. Following “screw placement” described below, the entire plate/bone assembly may then be transferred to the surgical site.

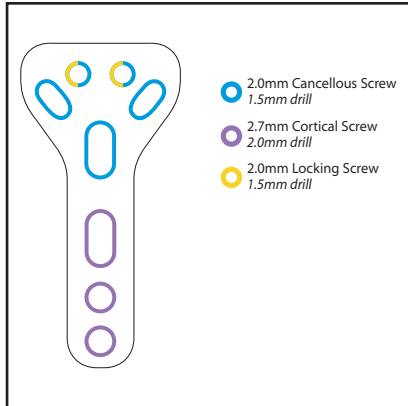


FIGURE 12 |

STEP 4 - HEAD SCREW PREPARATION

Correct screw and drill usage is shown in | **FIGURE 12**. The screw holes in the head portion of the plate are designed to receive 2.0mm cancellous screws, which are placed in a unicortical fashion. Care must be taken not to perforate into the PRUJ. The two central holes can receive either locking or non-locking screws; the locking screws will provide fixed-angle fixation of the radial head, while the non-locking screws will lag the plate down to the bony surface. The elongated outboard holes in the head of the plate receive only non-locking screws, which can be directed to retain difficult fragments.

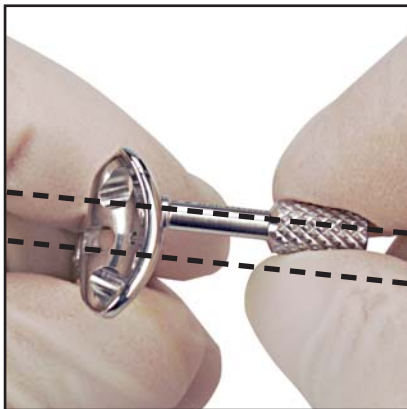


FIGURE 13 |

To prepare for 2.0mm locking screws, the locking drill guides must be used (P/N 2490-1510). The locking screw holes are manufactured parallel to one another, and care should be taken to thread the locking drill guide in the proper orientation | **FIGURE 13**.



FIGURE 14 |

Using the 1.5mm drill (P/N 2490-1500), drill up to (but not through) the opposing cortex in both locking screw holes | **FIGURE 14**.

To prepare for the 2.0mm non-locking screws, the 1.5mm drill is used with the corresponding end of the variable angle drill guide (P/N 2490-1520).



FIGURE 15 |

All drill guides must be removed prior to measuring screw length with the depth gauge (P/N 2490-0020) | **FIGURE 15.**



FIGURE 16 |

STEP 5 - HEAD SCREW PLACEMENT

Screws are delivered to the operative site using the self-retaining cruciform driver (P/N 2490-0084). To pick up the screws, the driver is pressed firmly into the screw head while the screw is still in the caddy | **FIGURE 16.**

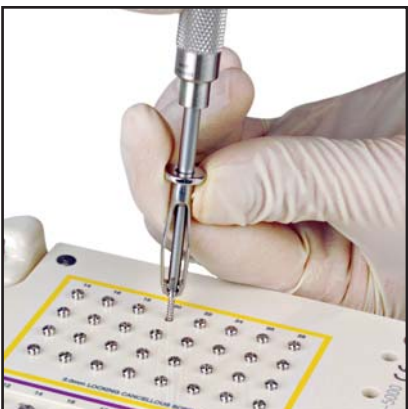


FIGURE 17 |

Alternatively, the screws may be picked up with the aid of the screw grasper (P/N 2490-1530) | **FIGURE 17.**

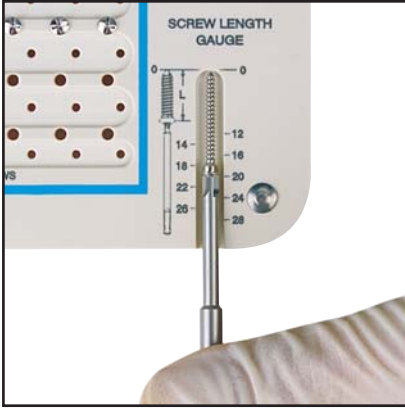


FIGURE 18 |

Screw length is verified with the gauge on the screw caddy; with the tip of the screw at the "0" line, the measurement is taken at the top of the screw head

| FIGURE 18.

The first screw to be inserted should be a 2.0mm NON-LOCKING screw in one of the locking screw holes. This screw will set the plate in close apposition to bone, and may be removed later and replaced with a 2.0mm locking screw if necessary.

The plate should then be securely attached to the radial head using as many 2.0mm screws as necessary. The elliptical slot where the head of the plate meets the stem can be used in several ways:

- To provide additional purchase into the head fragments
- As an interfragmentary screw from the shaft into the head
- For bicortical fixation of the radial shaft

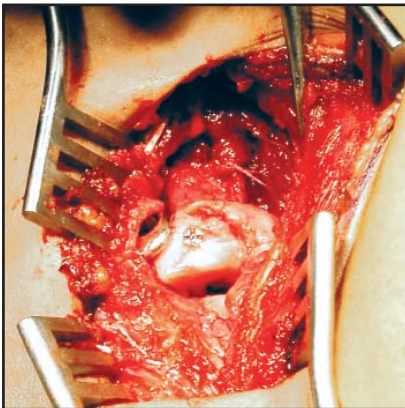


FIGURE 19 |

It is also possible to "freehand" the 2.0mm non-locking screws outside the plate to retain difficult fragments, provided that the heads are buried beneath the articular cartilage | FIGURE 19.

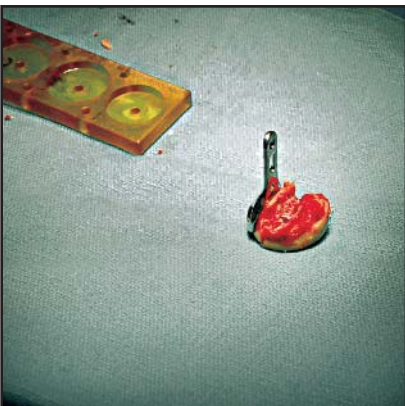


FIGURE 20 |

If the plate and radial head fragments have been assembled *ex-vivo*, the entire assembly is placed back in the surgical site and approximated to the shaft of the radius | FIGURE 20.

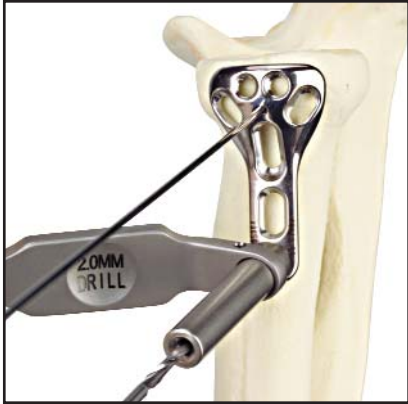


FIGURE 21 |

STEP 6 - SHAFT FIXATION

The screw holes in the shaft portion of the plate are designed to receive 2.7mm cortical screws, which can be used for bicortical fixation. The procedure is the same as for the 2.0mm non-locking screws, except the 2.0mm drill (P/N 2490-0008) is used with the corresponding end of the variable angle drill guide | **FIGURE 21**.

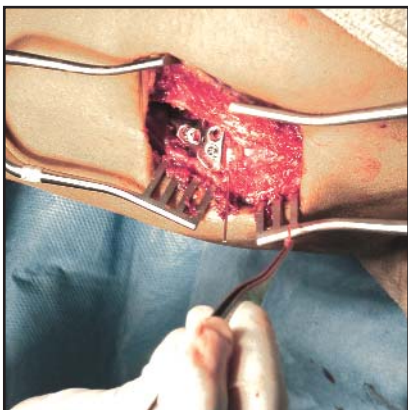


FIGURE 22 |

By placing the first screw in the elliptical shaft hole, position of the plate can be adjusted for compression across the radial neck fracture line before final screw placement | **FIGURE 22**. The remainder of the screws are then placed as described above.



FIGURE 23 |

Fluoroscopy is used to confirm final fracture reduction and hardware position. The elbow is taken through a full range of motion to ensure that there is no impingement or impedance of motion | **FIGURE 23**.

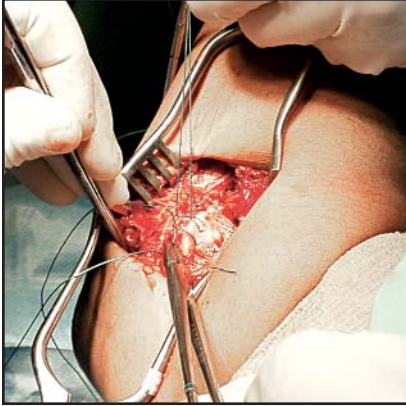


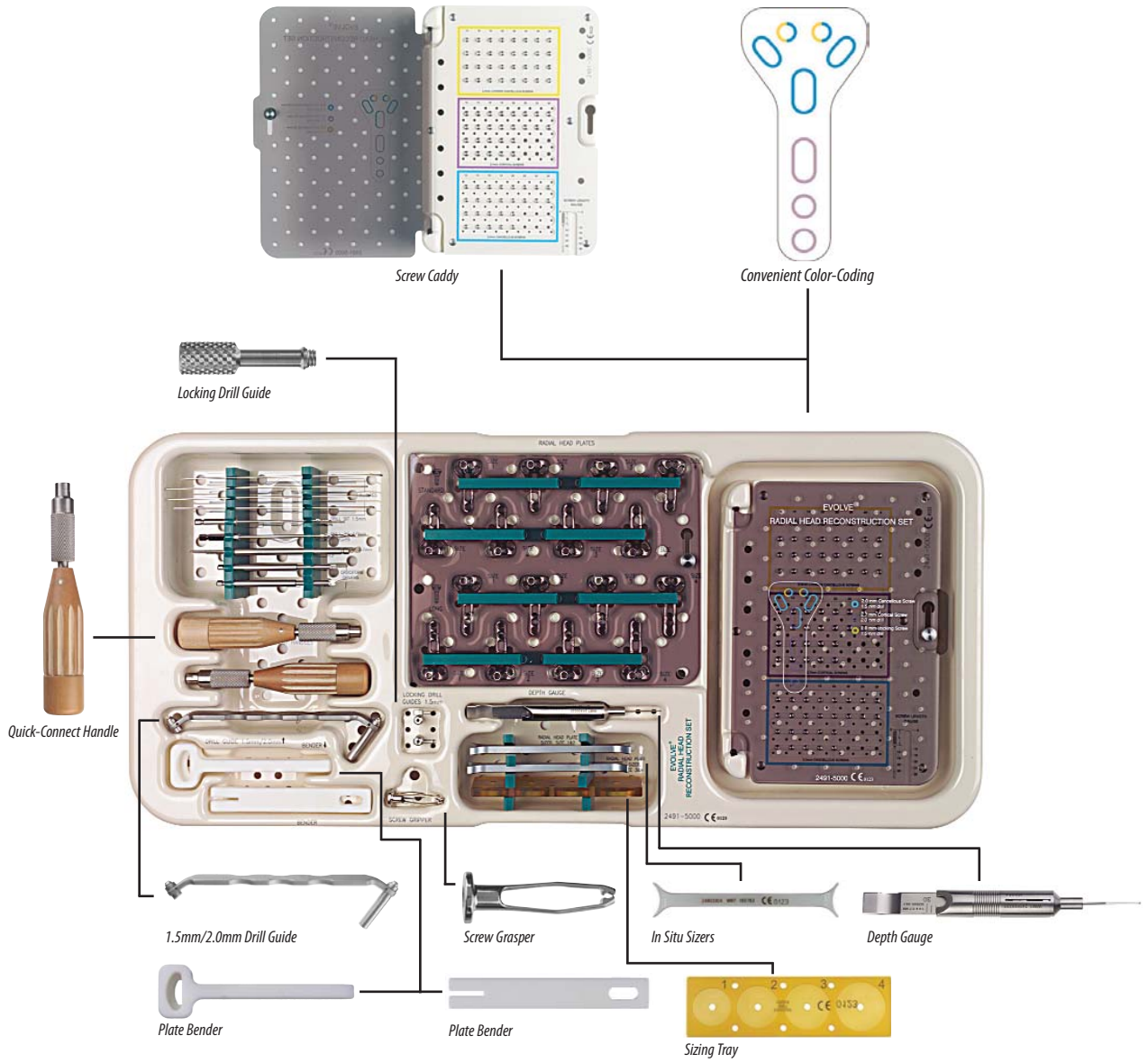
FIGURE 24 |

STEP 7 - CLOSURE - POST OP

The wound is irrigated before closure. The capsule is sutured in an interrupted manner with a #0 or larger braided nonabsorbable suture. The competence of the LUCL should be assessed and repaired if compromised by injury or the surgical approach. This can be accomplished with heavy sutures, drill holes or suture anchors. The skin is closed in layers. Post-operatively, the arm is started on immediate range of motion under the guidance of a trained therapist (if not precluded by other injuries of the elbow) | **FIGURE 24.**

REFERENCES

- 1 King GJ. Management of Radial Head Fractures With Implant Arthroplasty. *J Am Soc Surg Hand* 2004 Feb; Vol.4 No.1: 11-26.
REPRINTS AVAILABLE FROM WRIGHT MEDICAL: PART NUMBER SO 016-104.
- 2 Beingsneser DM, Dunning CE, Gordon KD, Johnson JA, King GJ. The effect of radial head excision and arthroplasty on elbow kinematics and stability. *J Bone Joint Surg Am* 2004 Aug;86-A(8):1730-9.
- 3 King GJ, Zarzour ZD, Rath DA, Dunning CE, Patterson SD, Johnson JA. Metallic radial head arthroplasty improves valgus stability of the elbow. *Clin Orthop* 1999 Nov(368):114-25.





ORDERING information

EVOLVE® RADIAL HEAD PLATE IMPLANTS

PART NUMBER	DESCRIPTION	KIT QTY
4910S001	EVOLVE® Proximal Radial Head Plate - Std Sz 1	2
4910S002	EVOLVE® Proximal Radial Head Plate - Std Sz 2	2
4910S003	EVOLVE® Proximal Radial Head Plate - Std Sz 3	2
4910S004	EVOLVE® Proximal Radial Head Plate - Std Sz 4	2
4910L001	EVOLVE® Proximal Radial Head Plate - Long Sz 1	2
4910L002	EVOLVE® Proximal Radial Head Plate - Long Sz 2	2
4910L003	EVOLVE® Proximal Radial Head Plate - Long Sz 3	2
4910L004	EVOLVE® Proximal Radial Head Plate - Long Sz 4	2
49110414	LOCKING CANCELLOUS BONE SCREW 2.0MM (14MM)	4
49110416	LOCKING CANCELLOUS BONE SCREW 2.0MM (16MM)	4
49110418	LOCKING CANCELLOUS BONE SCREW 2.0MM (18MM)	4
49110420	LOCKING CANCELLOUS BONE SCREW 2.0MM (20MM)	4
49110422	LOCKING CANCELLOUS BONE SCREW 2.0MM (22MM)	4
49110424	LOCKING CANCELLOUS BONE SCREW 2.0MM (24MM)	4
49110426	LOCKING CANCELLOUS BONE SCREW 2.0MM (26MM)	4
49110428	LOCKING CANCELLOUS BONE SCREW 2.0MM (28MM)	4
24910012	CANCELLOUS SCREW CRUCIFORM DRIVE 2.0 (12MM)	4
24910014	CANCELLOUS SCREW CRUCIFORM DRIVE 2.0 (14MM)	4
24910016	CANCELLOUS SCREW CRUCIFORM DRIVE 2.0 (16MM)	4
24910018	CANCELLOUS SCREW CRUCIFORM DRIVE 2.0 (18MM)	4
24910020	CANCELLOUS SCREW CRUCIFORM DRIVE 2.0 (20MM)	4
24910022	CANCELLOUS SCREW CRUCIFORM DRIVE 2.0 (22MM)	2
24910024	CANCELLOUS SCREW CRUCIFORM DRIVE 2.0 (24MM)	2
24910026	CANCELLOUS SCREW CRUCIFORM DRIVE 2.0 (26MM)	2
24920012	CANCELLOUS SCREW CRUCIFORM DRIVE 2.7 (12MM)	4
24920014	CANCELLOUS SCREW CRUCIFORM DRIVE 2.7 (14MM)	4
24920016	CANCELLOUS SCREW CRUCIFORM DRIVE 2.7 (16MM)	4
24920018	CANCELLOUS SCREW CRUCIFORM DRIVE 2.7 (18MM)	4
24920020	CANCELLOUS SCREW CRUCIFORM DRIVE 2.7 (20MM)	4
24920022	CANCELLOUS SCREW CRUCIFORM DRIVE 2.7 (22MM)	2
24920024	CANCELLOUS SCREW CRUCIFORM DRIVE 2.7 (24MM)	2
24920026	CANCELLOUS SCREW CRUCIFORM DRIVE 2.7 (26MM)	2
24900090	K-WIRE	4
24901500	DRILL BIT 1.5MM	1
24900008	DRILL BIT 2.0MM	1

INSTRUMENTS

24901520	DRILL GUIDE 1.5MM/ 2.0MM	1
24900019	QUICK CONNECT HANDLE	2
24900020	MINI SCREW DEPTH GAUGE	1
24901510	EVOLVE® LOCKING DRILL GUIDE 1.5mm	2
25949474	EVOLVE® BONE TAP 2.7mm	1
24900084	CRUCIFORM DRIVER RADIAL HEAD PLATE	2
24903000	EVOLVE® RHP SIZER TRAY	1
24903102	EVOLVE® RADIAL HEAD PLATE SIZER, SIZE 1/2	1
24903304	EVOLVE® RADIAL HEAD PLATE SIZER, SIZE 3/4	1
24900100	EVOLVE® RADIAL HEAD PLATE HEAD BENDER	1
24900101	EVOLVE® RADIAL HEAD PLATE STEM BENDER	1
24901530	SCREW GRASPER	1

SURGICAL TRAY

24915000	INSTRUMENT TRAY AND SCREW CADDIE	1
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