VPC™
(Variable Pitch Compression)
Screw System

Surgical Technique
Contents

Introduction ................................................ Page 1
Product Description .................................... Page 2
Indications .................................................. Page 3
Classification Of Scaphoid Fractures ........ Page 4

Surgical Technique
   Patient Preparation .................................. Page 6
   Guide Wire Placement ................................ Page 8
   **VPC** Screw Insertion (Mini Screw) ........ Page 9
   Closure And Post Operative Care ............ Page 10
   Percutaneous And Arthroscopically Assisted Techniques .................. Page 11

Mini **VPC** Screws And Instruments .......... Page 12
Micro **VPC** Screws And Instruments .......... Page 13
**VPC** Screw System:
   Universal Instruments .............................. Page 14
References ................................................ Page 16
Further Information .................................... Page 17
Introduction

The VPC (Variable Pitch Compression) Screw is a stainless steel variable pitch screw designed to provide stable fixation and compression of small bone fragments where a protrusive screw head is undesirable. The combination of a small diameter and non-threaded central portion minimizes the amount of bone sacrificed during a surgical procedure.

The VPC Screw is indicated for fusions, fractures or osteotomies of the upper and lower extremities.

Micro VPC Screws

The VPC Screw is available in a smaller, noncannulated micro bone screw version. The Micro VPC Screw is a headless screw with two differing thread pitches to allow for compression between bone fragments. Micro VPC Screws are available in the sizes/lengths referenced on page 2.

Mini VPC Screws

The Mini VPC Screw is a cannulated headless screw, with two differing thread pitches to allow for compression between bone fragments. Mini VPC Screws are available in the sizes/lengths referenced on page 2.
### Product Description

<table>
<thead>
<tr>
<th>Screw Type</th>
<th>Proximal Diameters</th>
<th>Proximal Pitch</th>
<th>Shaft Diameter</th>
<th>Distal Diameters</th>
<th>Distal Pitch</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mini VPC Screws</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(non-cannulated)</td>
<td>Proximal Diameters</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major Diameter = 3.8mm to 3.9mm</td>
<td>Minor Diameter = 2.6mm to 2.1mm</td>
<td>1.0mm</td>
<td>1.6mm</td>
<td>Major Diameter = 2.5mm</td>
<td>1.4mm</td>
</tr>
<tr>
<td><strong>Micro VPC Screws</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major Diameter = 3.8mm to 3.9mm</td>
<td>Minor Diameter = 2.6mm to 2.1mm</td>
<td>1.0mm</td>
<td>1.6mm</td>
<td>Major Diameter = 2.5mm</td>
<td>1.4mm</td>
</tr>
</tbody>
</table>

*Micro VPC Screws are available in lengths 12mm to 26mm (increments of 1.0mm)*

---

<table>
<thead>
<tr>
<th>Screw Type</th>
<th>Proximal Diameters</th>
<th>Proximal Pitch</th>
<th>Shaft Diameter</th>
<th>Distal Diameters</th>
<th>Distal Pitch</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mini VPC Screws</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(cannulated)</td>
<td>Proximal Diameters</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major Diameter = 4.4mm to 3.9mm</td>
<td>Minor Diameter = 3.1mm to 2.7mm</td>
<td>1.0mm</td>
<td>2.1mm</td>
<td>Major Diameter = 3.0mm</td>
<td>1.8mm</td>
</tr>
</tbody>
</table>

**Mini VPC Screws are available in lengths 12mm to 30mm (increments of 1.0mm)**
Indications

Fixation of scaphoid fractures and nonunions, osteotomies and fractures of the carpus and hand or foot, intra-articular fractures, osteochondral fractures, and small joint arthrodesis.

The biomechanical and vascular characteristics of the scaphoid result in a relatively high incidence of complications associated with fracture. Anatomic reduction and stable internal fixation of displaced scaphoid fractures has been shown to increase the rate of union and limit the sequelae associated with these difficult fractures. Fixation of nondisplaced unstable fractures has also been advocated in some clinical situations to limit the need for immobilization enhancing a more rapid functional recovery. In the setting of an established scaphoid nonunion, open reduction in conjunction with cancellous or cortico-cancellous bone grafting and internal fixation has been shown to result in a high rate of union restoring intercarpal relationships in an attempt to prevent or delay degenerative changes.

By avoiding the use of plaster or fiberglass, early (protected) joint motion is possible. There appears to be accelerated bone healing which could lead to a more rapid functional recovery. The complications of plaster, i.e. joint stiffness, osteoporosis, and muscle atrophy are avoided. Internal fixation using the VPC Screw is indicated in the treatment of all acute, unstable fractures (Type B) of the scaphoid, or whenever prolonged plaster or fiberglass immobilization is contraindicated. Similarly, internal fixation has proven to be invaluable as an adjunct to bone grafting for scaphoid nonunion (Type C).
The scaphoid bone is in the most lateral (radial) position in the proximal row of wrist bones. It is a common fracture site (from falling on an outstretched arm) and frequently has healing complications due to poor blood supply. The following classification of scaphoid fractures is recommended:

### Type A: Acute, Stable

Union may be expected after immobilization of the wrist for six weeks in a Colles-type plaster or fiberglass. However, internal fixation may be indicated when the patient declines the use of plaster or fiberglass.

- **Type A1:** Fracture of the Tubercle
- **Type A2:** Incomplete Fracture Through Waist

### Type B: Acute, Unstable

Open reduction and screw fixation are indicated in comminuted fractures; supplementary bone grafting may be required. In oblique fractures, additional k-wires fixation may be necessary.

- **Type B1:** Distal Oblique Fracture
- **Type B2:** Complete Fracture of Waist
- **Type B3:** Proximal Pole Fracture
- **Type B4:** Transscaphoid - Perilunate Fracture Dislocation of Carpus
**Type C: Delayed Union**

Screw fixation, with or without bone grafting, is indicated. However, it is recommended to leave the wrist free of plaster or fiberglass for a minimum of two weeks prior to surgery.

**Type D1: Fibrous Nonunion**

The fibrous tissue should be completely excised and suitable bone graft (cancellous or cortico-cancellous) inserted prior to screw insertion.

**Type D2: Pseudarthrosis**

Reconstruction of the scaphoid involves resection of the pseudarthrosis and correction of the deformity, using a substantial cortico-cancellous bone graft from the iliac crest. Surgery is only indicated after careful assessment of the patient's expectations and disability.
Surgical Technique

Patient Preparation

The patient is positioned supine with a radiolucent hand table. General or regional anesthesia is recommended. A proximal pneumatic tourniquet is utilized and the arm is prepped and draped in the usual orthopedic fashion. If the need for an iliac crest bone graft is anticipated, the chosen anterior iliac crest is prepped and draped. Exposure may be facilitated by a small bump placed beneath the hip.

Volar Approach

The majority of displaced scaphoid fractures are approached volarly. This facilitates fracture visualization and reduction without risk of compromising the dorsal vasculature. The volar approach also allows for the correction of the classic apex dorsal or “humpback” deformity associated with scaphoid nonunions in addition to allowing optimal bone graft placement.

The skin incision is centered over the scaphoid tuberosity, which is easily palpated. The incision is made just radial to the Flexor Carpi Radialis (FCR) tendon curving radially at the wrist flexion crease. The superficial palmar branch of the radial artery will be encountered crossing the surgical field and should be ligated.

The FCR tendon sheath is incised and the tendon retracted ulnarly. The floor of the sheath is incised over the scaphoid tuberosity and extended proximally into a wrist arthrotomy. To adequately visualize the proximal scaphoid it will be necessary to incise the volar radioscaphocapitate ligament. This should be repaired at the time of capsular closure. Distally, the incision should be extended splitting the thenar musculature in line with the fibers to expose the entire scaphoid tuberosity and the trapezial articulation. The exposure is facilitated by positioning and maintaining the wrist in a dorsiflexed position. Care should be taken not to dissect dorsally, placing the vascular supply at risk, and the scapholunate ligament should not be disrupted with proximal dissection.

The fracture can now be visualized and the hematoma and fibrous tissue gently irrigated and debrided. The fracture is anatomically reduced under direct vision and reduction confirmed fluoroscopically. Reduction can be facilitated by the curved 9mm spoon or the dual elevator in the set, which is optimally placed radically at the waist to affect and maintain a reduction. In the setting of a nonunion, all fibrous tissue is debrided and the bone curetted of cystic tissue. The deformity is then reduced and the defect templated for a graft. The graft should be seated prior to pin placement to allow capture if possible.
Dorsal Approach

Proximal pole fractures and non-displaced waist fractures are best approached dorsally. The proximal pole is localized fluoroscopically and a 1.5-2.0cm incision is placed distal to Lister’s tubercle. Dissection is carried through the subcutaneous tissues with care to protect branches of the superficial radial nerve.

The interval lies between the tendons of the third and fourth compartments. The extensor retinaculum is opened and the Extensor Pollicis Longus (EPL), Extensor Carpi Radialis Longus (ECRL) and Extensor Carpi Radialis Brevis (ECRB) tendons are retracted radially and the Extensor Digitorum Communis (EDC) tendons retracted ulnarly (Image 1a).

The capsule is incised longitudinally over the proximal pole with care to protect the scapholunate ligament and the vasculature of the dorsal ridge. The fracture is visualized and anatomically reduced. Visualization of the fracture and guide wire placement is facilitated by palmar flexion of the wrist. The starting point is ulnar near the scapholunate ligament (Image 1b).

Optimal guide wire placement is perpendicular to the fracture. A shorter screw may be necessary to facilitate optimal placement. After confirming reduction and guide wire placement screw insertion is completed as described above.

Image Source: (Image 1a-1b) Freeland, A.E., Bloom, H.T., Moore, J.B., Wegener. www.hand-surgery.co.uk
Surgical Technique (Continued)

Guide Wire Placement
(For Mini VPC Screw Insertion)

When utilizing a **volar** approach, the guide wire (P/N 04865) is placed in a distal to proximal fashion through the scaphoid tuberosity. Proper placement is facilitated by dorsiflexion of the wrist and elevation of the distal pole of the scaphoid. This may require resection of a small portion of the trapezium and is facilitated by the dual elevator (P/N 04890). The optimal starting point is slightly radial on the tuberosity. The guide pin is placed centrally in the scaphoid waist and should be advanced proximally enough to allow adequate purchase of the threads in the proximal fragment. (Image 2)

When a **dorsal** approach is utilized, visualization of the fracture and guide wire placement is facilitated by palmar flexion of the wrist. The starting point is ulnar, near the scapholunate ligament. Optimal guide wire placement is perpendicular to the fracture. A shorter screw may be necessary to facilitate optimal placement. (Image 3)

Regardless of the approach, fluoroscopic imaging in multiple planes is critical to confirm appropriate intraosseous position of the guide wire to prevent any articular penetration of the threads. After confirming position of the guide pin, a second pin should be placed peripherally to prevent rotation or displacement during screw insertion. (Image 4)

Image 2
Initial Pin Stabilization

Image 3
Secondary Anti-rotational Guide Pin

Image 4

Image Source: (Image 2) Richard Moore, M.D. (Image 3-4) Thomas Graham, M.D.
### VPC Screw Insertion (For Mini VPC Screw)

*Images 5a-6*

The color-coded yellow cannulated drill bit (P/N 04850) is placed on the ratcheting AO handle (P/N 22880) and under fluoroscopic guidance, manually advanced over the guide wire to the appropriate depth. The appropriate screw length can be determined by the calibrations on the drill bit when advanced through the similarly color-coded drill guide (P/N 04760), or the cannulated depth gauge (P/N 04655) can be utilized. The cannulated depth gauge allows fluoroscopic visualization of the screw tract for precise measurement. The drill is removed and the cannulated depth gauge advanced over the guide pin to the appropriate depth. The shank is seated against the bone and the appropriate screw length is determined by the calibrated rule at the proximal end of the handle. The end of the pin is often visible within the cannulated tract of the depth gauge but is not utilized for measurement. The depth gauge is removed and the color-coded yellow counter sink (CSK) drill bit (P/N 04685) is placed on the ratcheting AO handle and advanced over the guide wire.

<table>
<thead>
<tr>
<th>Image 5a</th>
<th>Initial Screw Insertion Radiographs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image 5b</td>
<td></td>
</tr>
</tbody>
</table>

**It is important that the CSK drill bit be advanced to the proximal portion of the threads to allow the screw to be adequately buried into the subchondral bone and to avoid protrusion of the head.**

A screw approximately 2mm shorter than the drilled depth is selected to allow proper seating of the screw head and is placed over the guide wire. The screw should be advanced across the fracture and the head seated beneath the articular surface. **It is rarely necessary to tap, except in extremely dense bone; however, the final few turns of the screw should be performed with the noncannulated solid screwdriver (P/N 04860) after removal of the guide pin.**

It is important to ensure that the screwdriver is completely engaged in the screw head prior to the final few turns. The fracture line should be directly visualized to ensure that there is no rotation or displacement as the screw is inserted and stability of the graft confirmed in cases of nonunion. Final fluoroscopic views in multiple planes are obtained to confirm reduction, intraosseous screw position and intercarpal relationships.

*Image Source: (Image 5a-5b) Thomas Graham, M.D.*
*Image Source: (Image 6) Andre Szymanowicz.*

Andre.szymanowicz@ebimed.com
Surgical Technique (Continued)

Closure And Postoperative Care
Images 7a-8c

Volar Approach

The radioscaphocapitate ligament is repaired with fine nonabsorbable suture and the capsule closed with the floor of the Flexor Carpi Radialis (FCR) tendon sheath. The thenar musculature is approximated with fine Vicryl® suture and, after confirming hemostasis, the skin is closed with fine nylon suture. A well-padded thumb spica splint (Biomet® Thumb Spica Splint) is applied for approximately 10 days. Elevation is maintained for 48 hours with digital range of motion. After suture removal, a light splint or cast is applied based on fracture stability.

Dorsal Approach

The capsule is closed and the skin approximated with fine nylon sutures. In acute, stable fractures, patients can typically be placed in a light molded thumb spica orthosis and begin gentle wrist range of motion. Follow-up x-rays are obtained post-op and at six week intervals. Union is expected over 6-12 weeks with unrestricted activity to follow. Nonunions necessitate an extended period of cast immobilization and may benefit from Pulsed Electromagnetic Fields (PEMF) external electrical stimulation.

Image Source: (Image 7a-7b) Richard Moore, M.D.
Percutaneous And Arthroscopically Assisted Techniques

Selected fractures may be amenable to percutaneous or arthroscopically assisted screw placement. The VPC Screw Instrumentation will allow screw placement in standard fashion.

Image 8a

Image 8b

Image 8c

Image Source: (Image 8a-8c) Thomas Graham, M.D.
Mini VPC Screws And Instruments

- **Mini VPC Screw**
  P/N: 04612 through 04630

- **Mini Countersink (CSK) Drill Bit**
  P/N: 04685

- **Mini Wire Guide (.039” Dia.)**
  P/N: 04765

- **Mini Cannulated 1.5mm Hex Driver**
  P/N: 04855

- **Mini Depth Gauge**
  P/N: 04655

- **Mini Drill Guide**
  P/N: 04760

- **Mini 2.0mm Drill Bit**
  P/N: 04850

- **Mini Solid 1.5mm Hex Driver**
  P/N: 04860
Micro VPC Screws And Instruments

Micro VPC Screw
P/N: 04712 through 04726

Micro Countersink (CSK) Drill Bit
P/N: 04680

Micro Solid 1.25mm Hex Driver
P/N: 04755

Micro Depth Gauge
P/N: 04660

Micro 1.4mm Drill Bit
P/N: 04750

Micro Drill Guide
P/N: 04770
VPC Screw System: Universal Instruments

Depth Gauge Drill Guide
P/N: 04775

Wire Plunger
P/N: 04780

Depth Gauge
P/N: 04870

Fragment Spoon
P/N: 04880

Fixed AO Handle
P/N: 22875

Ratcheting AO Handle
P/N: 22880

Dual Elevator
P/N: 04890

VPC Screw Tray
P/N: 03164
Mini VPC Screw Guide Wire (.035" Dia.) P/N: 04865

Mini Double TIP Guide Wire (.035" Dia.) P/N: 04866

VPC Screw System* P/N: 04696

*Standard screw sizes and instrumentation not yet FDA approved (not shown).
References

www.vandemarkortho.com

Freeland, A.E., Bloom, H.T., Moore, J.B., Wegener, E.E., ECRL Transfer to the Scaphoid Tubercle for Scapholunate Instability.
www.hand-surgery.co.uk

Classification of Scaphoid Fractures. Orthoteers.
www.orthoteers.co.uk

www.handuniversity.com
Further Information

This brochure describes the surgical technique used by Thomas J. Graham, M.D., Richard S. Moore, Jr., M.D. and Keith B. Raskin, M.D. Biomet Trauma, as the manufacturer of this device, does not practice medicine and does not recommend this product or any surgical technique for use on any individual patient. The surgeon who performs any implant procedure is responsible for determining the appropriate product(s) and utilizing the appropriate technique(s) for said implantation in each individual patient.

For further information, please contact the Customer Service Department at:

Biomet Trauma
100 Interpace Parkway
Parsippany, NJ 07054
(973) 299-9300 - (800) 526-2579
www.biomettrauma.com