

PRO

Pelvis and Acetabulum System

Operative technique



Pelvic and acetabular fracture

Operative technique

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This publication sets forth detailed recommended procedures for using Stryker devices and instruments. It offers guidance that you should heed, but, as with any such technical guide, each surgeon must consider the particular needs of each patient and make appropriate adjustments when and as required.

! WARNING

- Follow the instructions provided in our cleaning and sterilization guide (OT-RG-1).
- All non-sterile devices must be cleaned and sterilized before use.

! WARNING

Multi-component instruments must be disassembled for cleaning. Please refer to the corresponding assembly/ disassembly instructions.

Please remember that the compatibility of different product systems has not been tested unless specified otherwise in the product labeling.

Consult Instructions for Use (www.ifu.stryker.com) for a complete list of potential adverse effects and adverse events, contraindications, warnings and precautions.

The surgeon must advise patients of surgical risks, and make them aware of adverse effects and alternative treatments.

! WARNING

- The patient should be advised that the device cannot and does not replicate a normal healthy bone, that the device can break or become damaged as a result of strenuous activity or trauma and that the device has a finite expected service life.
- Removal or revision of the device may be required sometime in the future due to medical reasons.

Introduction

The surgical approaches and operative techniques described on the pages to follow are for the treatment of complex injuries to the pelvic structures.

! WARNING

The licensed healthcare professional and operating room team must be thoroughly familiar with the operating technique, the instruments, as well as the range of implants to be applied. Complete information and labeling on these subjects must be readily available at the workplace.

! WARNING

In the event of contamination, or expiration of shelf life or in the case of products supplied non-sterile, the product must be subjected to an appropriate cleaning process and sterilized by means of a validated sterilization procedure before use, unless specified otherwise in the product labeling or respective product technical guides.

Acknowledgments

Stryker acknowledges Michael Archdeacon, M.D, Pierre Guy, M.D., Joel Matta, M.D., and H. Claude Sagi, M.D. for their support in the preparation of this material.

Indications and contraindications

Indications for use

Matta pelvic plates

The Stryker Matta pelvic plates are indicated for:

- Fractures of the acetabulum, sacrum, ilium, and entire pelvic ring.
- Revision surgery of pseudoarthroses, non-unions, and mal-unions.
- Osteotomies.
- Arthrodeses.
- Sacroiliac joint dislocations.
- Symphysis pubis disruptions.

PRO quadrilateral surface plates

The indications for PRO Implant System include fractures of the following regions of the pelvis:

- Anterior column.
- Anterior column combined with posterior hemi-transverse.
- Quadrilateral surface.

Contraindications

The physician's education, training and professional judgment must be relied upon to choose the most appropriate device and treatment.

Conditions presenting an increased risk of failure include:

- Any active or suspected latent infection or marked local inflammation in or about the affected area.
- Compromised vascularity that would inhibit adequate blood supply to the fracture or the operative site.
- Bone stock compromised by disease, infection or prior implantation that cannot provide adequate support and / or fixation of the devices.
- Material sensitivity, documented or suspected.
- Obesity. An overweight or obese patient can produce loads on the implant that can lead to failure of the fixation of the device or to failure of the device itself.
- Patients having inadequate tissue coverage over the operative site.
- Implant utilization that would interfere with anatomical structures or physiological performance.
- Any mental or neuromuscular disorder which would create an unacceptable risk of fixation failure or complications in postoperative care.
- Other medical or surgical conditions which would preclude the potential benefit of surgery.

WARNING

The PRO Implant System has not been evaluated for safety in the MR environment. It has not been tested for heating or unwanted movement in the MR environment. The safety of PRO Implant System in the MR environment is unknown. Performing an MR exam on a person who has this medical device may result in injury or device malfunction.

PRO Implant System design Implants

Matta plates design summary

Stainless steel cold-worked and annealed plates

Variety of rigid and flexible plates designed to fit the pelvis surface.

Curved plates for male and female anatomy

Pre-contoured R88 and R108 curvatures designed to fit male and female pelvic anatomy.

Dedicated pubic symphysis plates

Pre-contoured plates with an increased midsection designed specifically for stabilizing the pubic symphysis.

Round and tapered plate edges

Designed to facilitate plate sliding submuscularly.

Wide screw angulation with Ø3.5mm screws

Enhanced for more choices for screw placement, especially for posterior wall fixation. Ø3.5mm screws allow for a 70° cone of angulation.



Matta pelvic plate types

Curved and straight plates

- Hard (cold-worked) material, 2.5mm thick, 16mm spacing between the holes.
- Curved R108 plates with holes ranging from 4 – 16*, 18 and 20.
- Curved R88 plates with holes ranging from 3 – 16*, 18 and 20.
- Straight plates (cold-worked) with holes ranging from 2 – 16*, 18 and 20.



Flex plates

- Soft (annealed) material, 2.5mm thick, 12mm spacing between the holes, higher malleability than hard plates.
- Straight plates (annealed) with holes ranging from 3 – 16*, 18 and 20.

Symphysis plates

- Hard (cold-worked) material, 3.2mm thick, 16mm spacing between the holes, 75mm radius.
- Symphysis plates offered in 4 hole and 6 hole options.

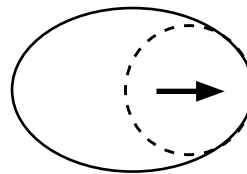
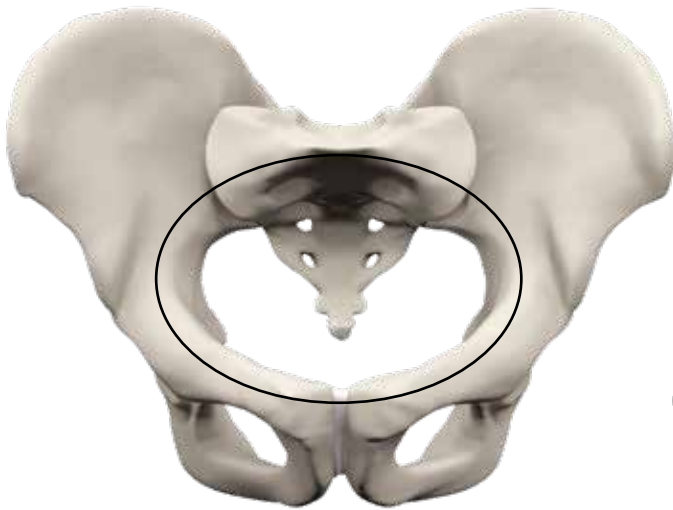
*Offered in 1 hole increments.

PRO Implant System design

Implants

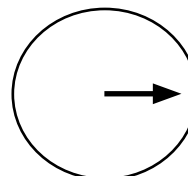
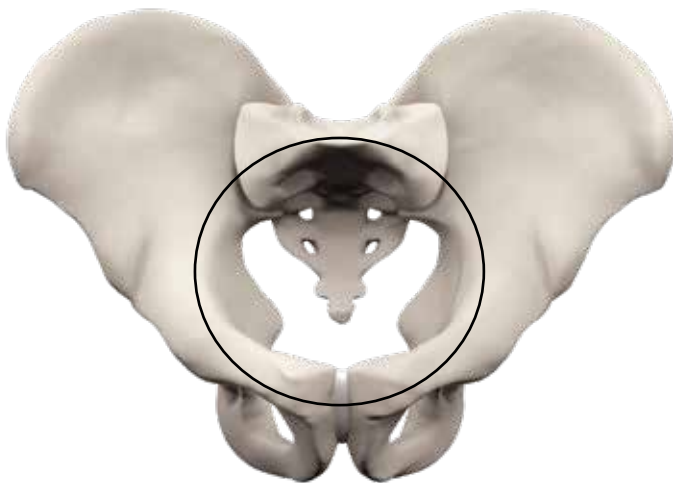
Matta pelvic plate types

Female pelvis



Radius 88mm

Male pelvis



Radius 108mm

PRO Implant System design

Implants

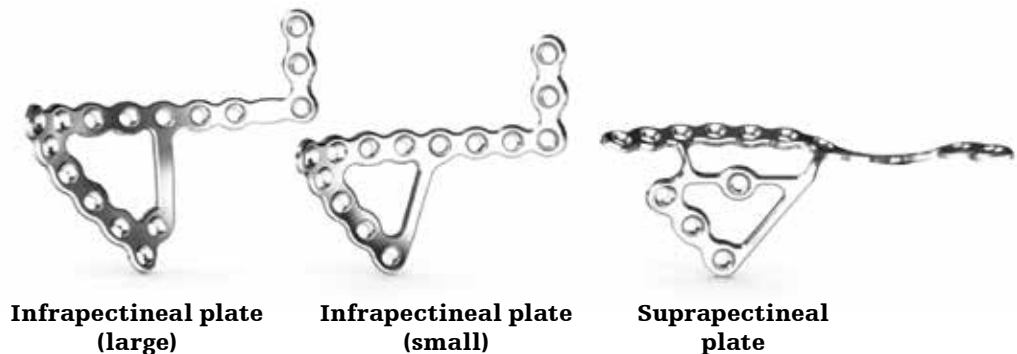
PRO quadrilateral surface plates

Three QLS plates are offered in the PRO solution: one suprapectineal plate and a large and small infrapectineal plate.

- Pre-contoured and designed using proprietary SOMA bone database and software applications
- Material: annealed stainless steel.
- Thickness: 2.5mm.
- Ø3.5mm and Ø4.5mm screws may be used with all plates.
- Available in left and right options.

Infrapectineal plate, large and small

The design of the infrapectineal plates allows them to buttress the quadrilateral surface in treatment of acetabular fractures with central dislocation, comminution, and disassociation of the quadrilateral surface from the posterior column.



14 screw holes in the small and 16 screw holes in the large infrapectineal plate are pre-angled away from the acetabulum and accept 3.5mm and 4.5mm screws.

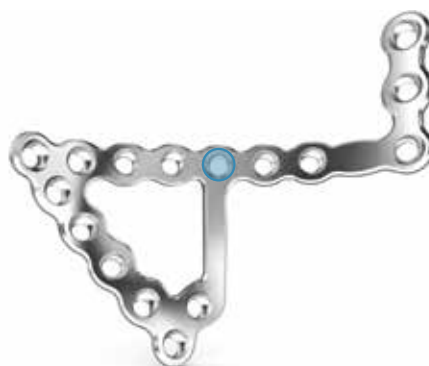
The central perpendicular hole is designed for attachment to the

handle for plate insertion (see blue circle in figures below), but it can attach to any screw hole.

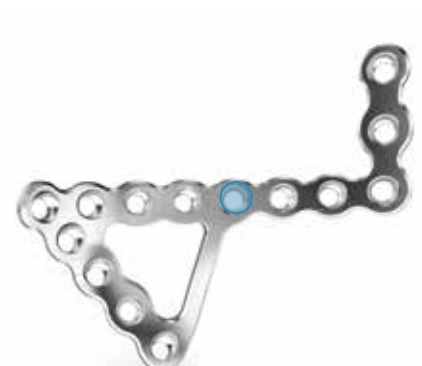
The anterior extension may be bent over the pubic ramus to get multiplanar fixation in this region.



L extension bent over pubic ramus



Infrapectineal plate (large)



Infrapectineal plate (small)

PRO Implant System design

Implants

Suprapectineal plate

The design of the suprapectineal plates allows them to buttress the quadrilateral surface in treatment of the following fractures:

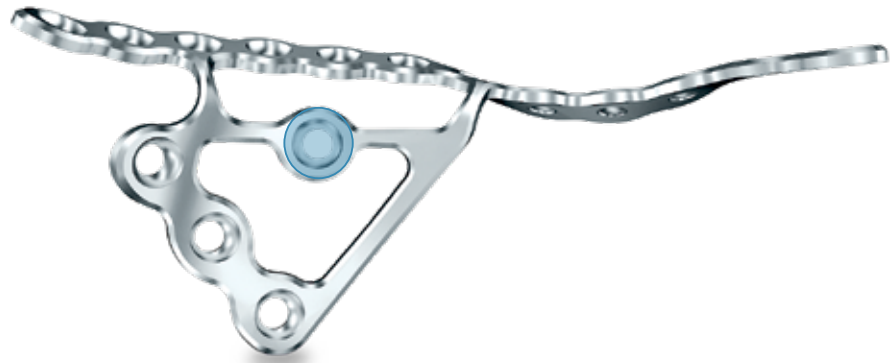
- Anterior column.
- Anterior column and posterior hemi-transverse.
- Associated both column.
- High transtectal transverse that exits the posterior column near the sciatic notch.

The single plate construct enables screw fixation along the pelvic brim and posterior column.

16 screw holes are pre-angled away from the acetabulum and accept 3.5mm and 4.5mm screws.

The central perpendicular hole is designed for attachment to the handle for plate insertion (see blue circle in figure to the right), but it can attach to any screw hole.

Refer to page 44 for additional technique guidance for the suprapectineal plate.



Suprapectineal plate

PRO Implant System design

Implants

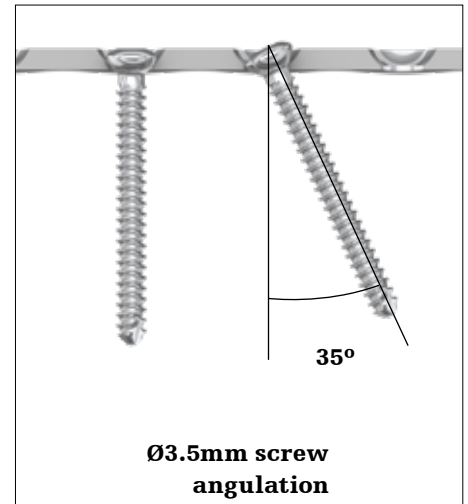
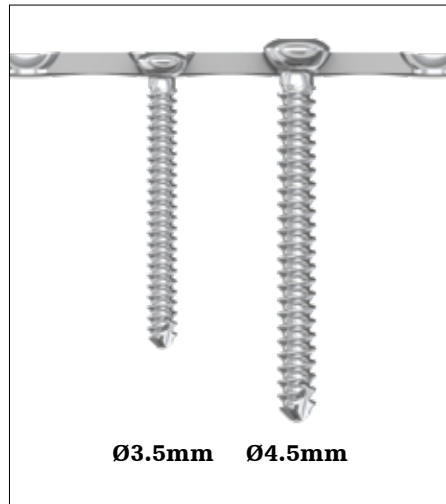
Matta pelvic system screws

Ø3.5mm self-tapping cortical screws are recommended for plate fixation. The plates are designed to have low screw / plate profiles and accept Ø3.5mm screws to be inserted at angles up to $\pm 35^\circ$ in all directions.

This increased screw angulation may be helpful to avoid penetrating the hip joint or to be able to drive a screw obliquely in the area of the iliac bone, avoiding a previously inserted, isolated screw.

Ø4.5mm cortical screws may also be used, however are less common.

Instrumentation is offered to allow the surgeon to fix plates to the bone and allow accurate independent screw placement.



⚠ WARNING

- Use a sharp drill bit when drilling bone, particularly in areas of hard, dense bone. This may offer the surgeon more control and help avoid plunging that may injure neurovascular structures, viscera, or other soft tissue structures. It may also lessen heat generation.
- Blunt drills should be discarded and replaced.
- Always use the designated drill sleeve/Plate Screw Inserter (see page 34) to assure accurate placement of the screw and to protect the adjacent soft tissues against the generation of heat and build-up of debris.
- The drill sleeves are also designed to prevent damage to the drill bit and to avoid the drill bits being seized or blocked in the sleeve.

PRO Implant System design

Instruments

Instrument design summary

Carbon fiber retractors

Four retractors designed to match the anatomic region being dissected. Retractors accept a light pipe and suction tube for improved visualization in deeper cavities and may be fixed in place with K-wires. Because they are made of radiolucent carbon fiber, there is no need to remove them for fluoroscopy.



K-wires

Two Ø3.2mm K-wires (150mm and 220mm lengths) are offered in the system to fix the retractors into place.



Angled ball spikes

Ball spike pushers are offered straight and at 15° and 30° angles, designed for fracture reduction in deep spaces.



Spiked screw inserters for Ø3.5mm and Ø4.5mm screws

The spiked screw inserter is an instrument for reduction and independent placement of Ø3.5mm or Ø4.5mm screws. The instruments are cannulated to allow for drilling and screw insertion through the instrument.



Spiked disk for spiked screw inserter

Larger spiked disk with K-wire holes may be used with the spiked screw inserter to allow for increased bone contact to aid with reduction.



Washer pick-up stand

A washer may be loaded into the Ø3.5mm spiked screw inserter utilizing the washer loading stand and allows for easy washer placement and screw insertion in a single step.



PRO Implant System design

Instruments

Instrument design summary

Plate screw inserter

The plate screw inserter can be used to push the plate down to the bone. It is also cannulated to allow for drilling, measuring, and inserting a screw through the instrument. The tip allows for swiveling and centering in the screw hole.



Handle for plate insertion

The handle for plate insertion can be attached to any hole in the PRO and/or Matta plates to facilitate plate insertion. The handle swivels to further assist with access and to achieve the desired plate placement.



Long scaled drills and drill guides

Ø2.5mm and Ø3.2mm x 450mm drills are offered in the PRO Implant System design to allow for drilling into deep spaces and through the cannulated spiked screw inserters and plate screw inserter.



Overdrills

Ø3.5mm and Ø4.5mm x 390mm overdrills are now offered in the PRO Implant System design in order to lag through the cannulated spiked screw inserters and plate screw inserter.



Long screwdriver





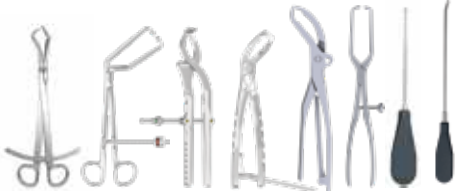


Screwdrivers with a handle or AO attachment are available to allow for screw insertion through the cannulated instruments (Spiked Screw Inserter and Plate Screw Inserter).



PRO Implant System design

Instruments

Instrument design summary

Plate bender	Designed for three-dimensional contouring of all Matta and PRO QLS plates.	
Plate bending holder	Allows for secure and controlled plate bending for both Matta and PRO plates.	
In-situ bender	Offers an option for in-situ plate bending.	
Angled depth gauge	Design allows for measuring along tangential or angulated drill paths in deep spaces.	
Range of reduction instruments	Variety of reduction forceps and enhanced clamp designs offer many options for fracture reduction and fragment repositioning.	
Screwdriver holding sleeve	Offers efficiency in screw pick-up, insertion, and removal.	
Elastosil handles	Surgeon may select a handle according to his/her preference.	

PRO Implant System design

Instruments

Instrument design summary

Four options of reduction pins (5mm or 6mm in 150mm or 180mm lengths)

Surgeon may select a pin appropriate to fragment or bone size.



Sciatic nerve retractors

Availability in two sizes, large and small.



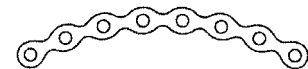
Spiked disks

Offer enhanced utility options with reduction forceps and ball spike pushers, which may allow for increased bone contact. K-wire holes have been incorporated to allow for temporary fixation during reduction.



MPS plate templates

Allow plate bending outside of the operative field.



PRO Implant System design

Trays

Tray design summary

Basic instrument tray with pre-formed inserts

Tray is designed to accommodate basic instruments for three screw sizes as well as additional specialty instruments designed for working in a deep surgical space through less invasive surgical approaches.



Dedicated retractor tray

An assortment of specialty retractors are included with the system.



Accessory instrument caddy

An optional instrument caddy has been added to the PRO Implant System design that will fit into the open space in the top layer of the PRO instrument tray. The caddy is designed to house the optional instruments including the Ø4.5mm spiked screw inserter, drill sleeve, screwdriver, and Ø3.2mm drill, as well as the overdrills.



Specialty reduction tray

An assortment of specialty pelvic reduction clamps designed for a variety of surgical approach.



PRO Implant System design

Retractors

Four retractors are designed to address the major issues related to working in deep wounds:

- Illumination.
- Obstructing of fluoroscopy images by retractors.
- Limited visibility of structures due to fluids in the wound.
- Handling.



Illumination

To enhance illumination in the surgical field, retractors 1, 2 and 3 may be equipped with a light pipe attachment.

This single-use, disposable fiber optic clip-on is designed to allow a consistent delivery of light to the deepest dissected area. Surgeon preference will dictate which retractor to put the light pipe attachment on.

The light pipe attaches to the fiber optic cable of a Stryker light source or standard endoscopic light source found in the OR via a Storz connection.

CAUTION

If there is excessive heat, the light source should be turned off until the light pipe has sufficiently cooled.



PRO Implant System design

Retractors

Imaging

The retractors are made of laminated carbon fiber and are radiolucent, therefore they do not need to be removed for fluoroscopy.

Suction feature

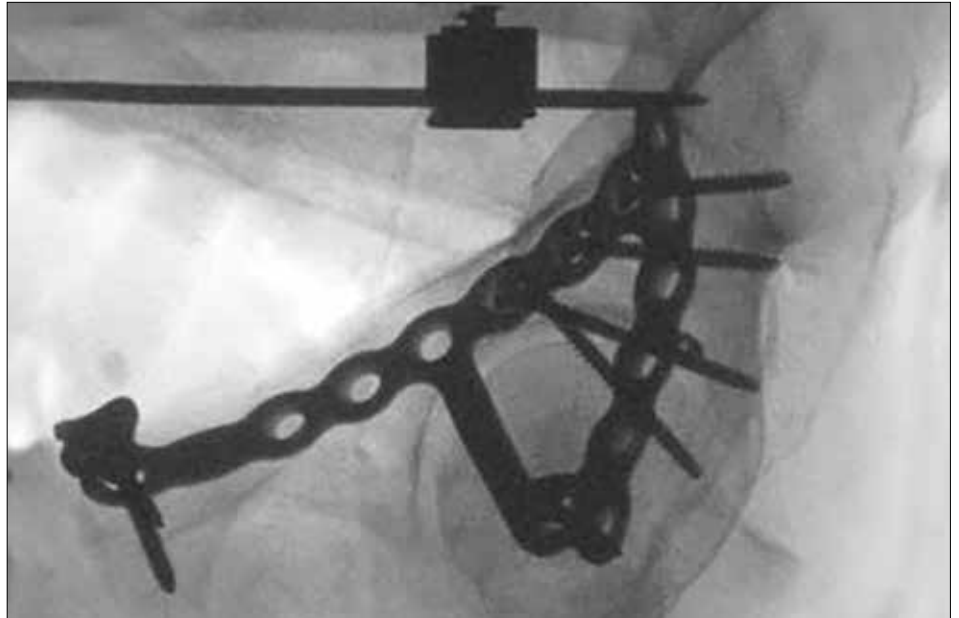
The suction retractor is specially designed so it not only functions as a deep retractor in the areas of the greater or lesser sciatic notch, but additionally serves as a suction device to irrigate blood and fluids that accumulate at the base of the wound.

The suction tip is a component in the retractor tray that gets inserted into sterile, 1/4" suction tubing. The groove that runs the length of the suction retractor accommodates the tubing.

Starting at the working end of the retractor, seat the suction tip first and progressively insert the tubing into the groove of the retractor.

NOTICE

Because of best fit characteristics, suction tubing from the companies to the right is recommended:
It might be that the suction tubing has to be cut at one side prior the attachment of the suction tip.



The X-ray above shows a radiolucent retractor held in place with a K-wire, pictured with an infrapectineal plate.



Producer	Description	REF	Inner Ø*
Dahlhausen	SCT - connector: funnel / vac.control	07.068.25.210	~5.6mm (-)
Covidien	Argyle: suction tube, molded connectors	8888301606	~6.3mm (1/4")
Amsino	Suction connecting tube	AS825	~6.3mm (1/4")
Cardinal Health	Medi-vac non-conductive suction tube	CAT. 66A	~6.3mm (1/4")
Legend M.D.	Suction connecting tube	Item#: RSCT201	~6.8mm (1/4")
Medline	Non-conductive connecting tube	DYND50246	~6.3mm (1/4")
Medi Plast	Orthopaedic suction Set	60QP09061	~6.3-6.6mm (-)

PRO Implant System design

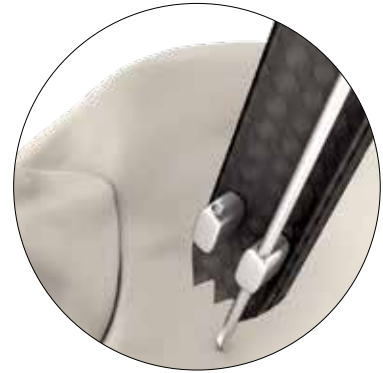
Retractors

Handling

Once the position of the retractors is established, they may be fixed with Ø3.2mm K-wires (150mm and 220mm lengths) provided in the retractor tray.

⚠ WARNING

Never put undue tension on retracted structures and adjust the retraction periodically to ensure the safe use of the devices.



NOTICE

Seat the Ø3.2mm K-wire to the bone before drilling to avoid unintended contact and debris.

Matta sciatic nerve retractors



Two sciatic nerve retractors (large and small) are available to allow for retraction in this area.



Sciatic nerve retractor

PRO retractor 1



Originally designed to be placed near the pubic tubercle, retractor 1 may be equipped with a light pipe and held in place with a Ø3.2mm K-wire.

The retractor may be used in additional anatomic areas as the surgeon sees fit.



Retractor 1



PRO Implant System design

Retractors

PRO retractor 2



Originally designed to be placed over the acetabular rim near the ilio-pubic eminence, retractor 2 may be equipped with a light pipe. However, there is no opportunity to fix this retractor in place with

K-wires to reduce the risk of inadvertently penetrating the joint.

This retractor may be used in additional anatomic areas as the surgeon sees fit.



Retractor 2

PRO retractor 3



Originally designed to be placed in the iliac fossa to retract the iliac vessels and ilio-psoas muscles, retractor 3 may be equipped with a light pipe and has 2 holes for K-wire fixation to allow for rotation.

Due to this anatomic positioning, retractor 3 may be the most ideal for light pipe attachment.

This retractor may be used in additional anatomic areas as the surgeon sees fit.



Retractor 3

PRO suction retractor



Originally designed to be placed in the lesser sciatic notch to retract the bladder away from the posterior column and QLS, the suction retractor has the ability to run standard tubing through the channel in the retractor to simultaneously provide suction and retraction.

This retractor may be used in additional anatomic areas as the surgeon sees fit.

WARNING

When using suction retractor, continue to monitor the amount of blood loss as per standard operating procedure.



Suction retractor

PRO Implant System design

Reduction instruments

Angled ball spike



Angled at 15° and 30° respectively, the angled ball spikes have increased length and are designed for working in narrow corridors or in areas where the irregular contours of the bone do not allow reduction clamps to be used. The angle allows flush application of the spike or disk at tangential surfaces, such as the interior intrapelvic and QLS areas.

To distribute reduction forces over a comminuted area, a spiked disk can be attached to the ball tip.

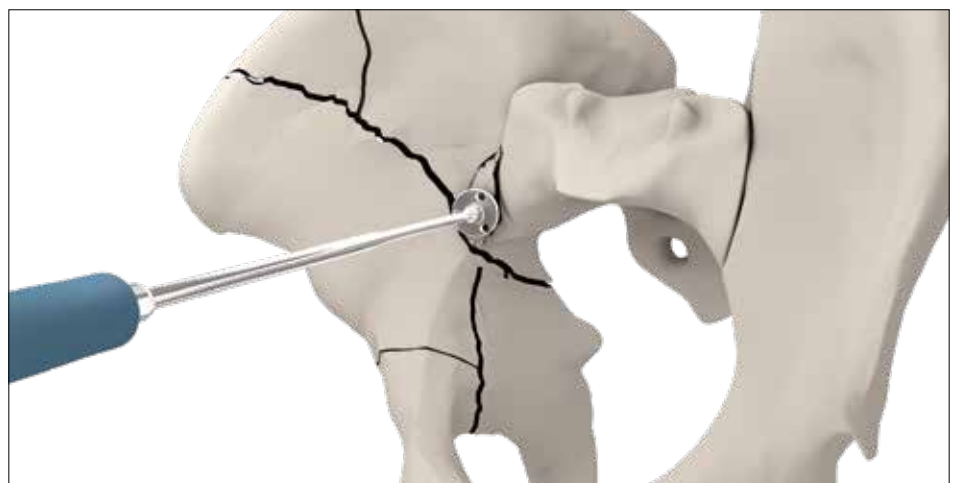
The angled ball spikes may also be used in conjunction with reduction clamps to fine tune reduction.



Straight ball spike



This reduction instrument is used as a pusher with pointed ball tip to reduce bone fragments. To distribute reduction forces over a comminuted area, the spiked disk can be attached to the ball tip.



PRO Implant System design

Reduction instruments

Design summary

Color coding

Clamps and tray are color coded to allow easier identification and communication in the OR and during clean up.



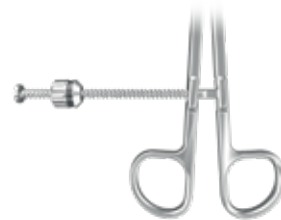
Four spike design

Tip design on angled jaw clamps is based on a 4-point ball spike, to provide the required grip on the bone surface and distribution of the applied force.



Longer speedlocks

Longer speedlocks offer a larger opening and enhance tip and arm angulation.



Asymmetry

Offset jaw clamps allow a wide range of application and are conducive to various surgical approaches.



Improved visualization

The wide Jungbluth, Contoured Weber, and angled Farabeuf are examples of clamps that are intuitively designed to sit away from the surgeon's working area or allow use with other instruments.



Distraction / compression

The Farabeuf's ratchet mechanism allows the clamp to be placed in compression or distraction mode to compress or distract fracture fragments.



PRO Implant System design

Jaw clamps

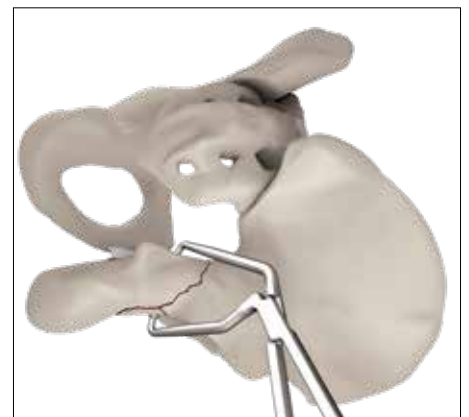
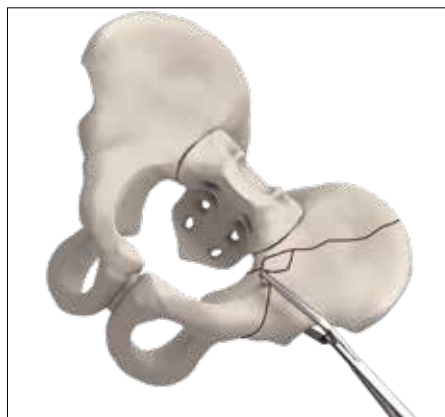
The jaw clamps are primarily used for acetabular fracture reduction through various windows of the ilioinguinal approach, the Kocher-Langenbeck approach, or Anterior Intrapelvic Approach. The clamps are fitted

with a threaded speedlock mechanism. The crown-spike tips allow for oblique application of force onto a bony surface and optional connection to the spiked disks available in either the Matta or PRO pelvis systems.

Standard jaw clamps



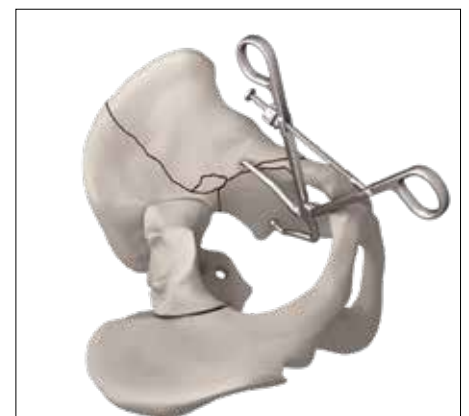
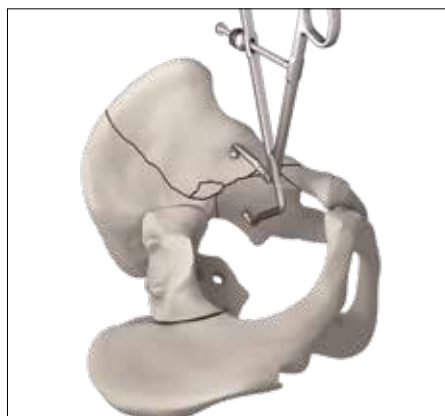
The standard angled jaw clamps are the workhorses which may be used in a variety of circumstances. The sharp points allow for a secure hold on the bone while the balls prevent penetration of bone with a thin cortex. The handles angle away from both the surgeon's line of sight and critical soft tissue structures.



Offset jaw clamps



The jaws of these clamps are offset with an overbite or underbite to accommodate particular surgical approaches and bony anatomy. The angle of the tine and offset of the jaw are designed to accommodate surfaces that are tangential to prevent skiving of one tine or the other.



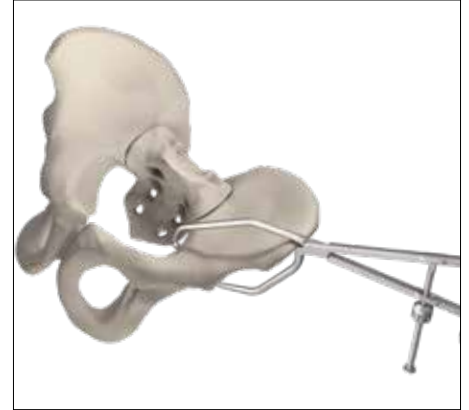
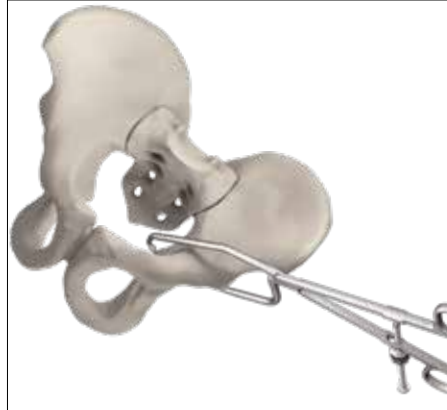
PRO Implant System design

Jaw clamps

Large offset jaw clamps



The large offset jaw clamps were designed to reduce acetabular fractures in areas where more clearance is needed between the jaws and where the bony anatomy precludes the use of more symmetric clamps.



PRO Implant System design

Weber clamps

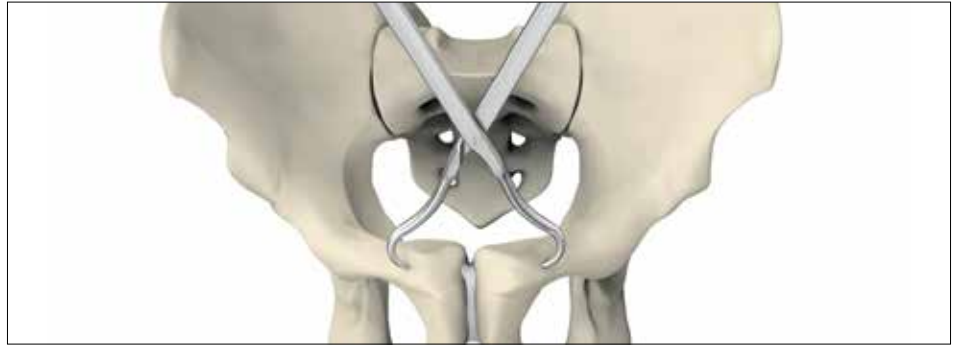
Pointed reduction forceps may be applied directly to the bone or for more stability, in shallow pre-drilled

holes using a Ø3.2mm or Ø3.5mm drill bit.

Standard Weber



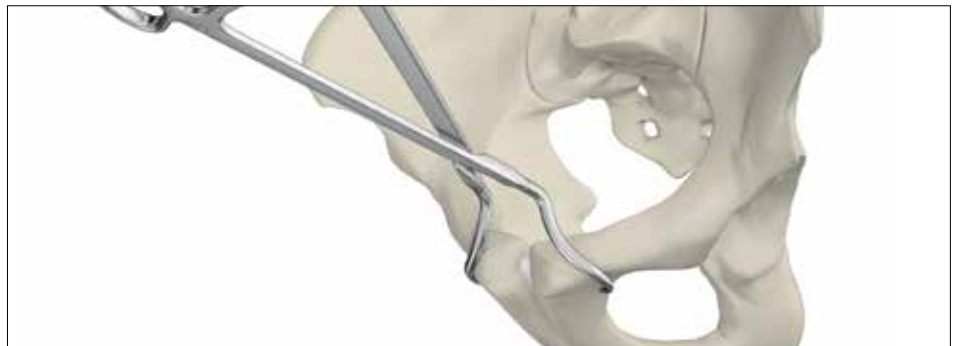
The Standard Weber may be applied directly to the bone in a variety of applications to stabilize the pubic symphysis or displaced pelvic fragments.



Contoured Weber



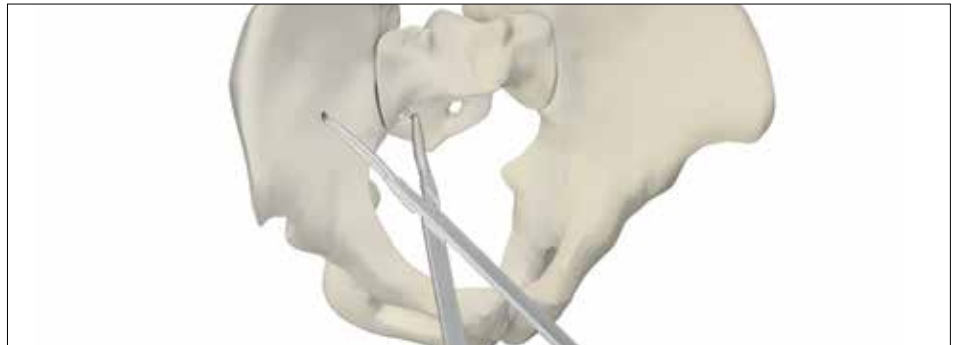
The Contoured Weber has a reverse bend designed to angle the handles away from the area of reduction and fixation.



Narrow Weber (Straight, Straight)



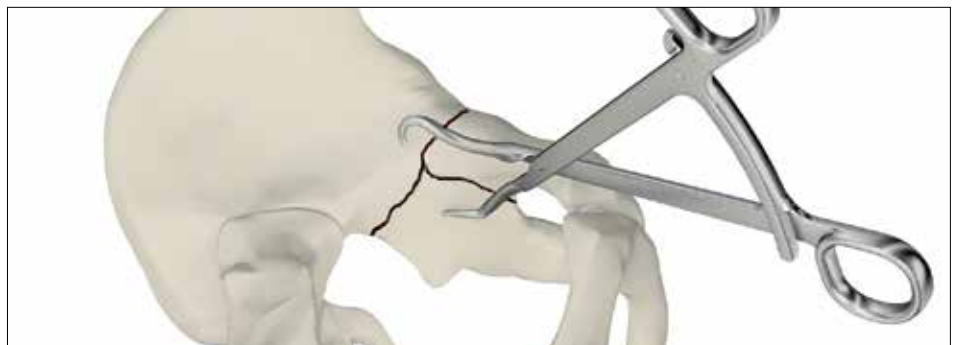
The Narrow Weber has two straight tines which may be used in areas where access is limited.



Asymmetric Webers (Straight, Curved)



Left and right asymmetric webers have one curved and one straight tine, which may be placed in shallow pre-drilled holes to gain stability.



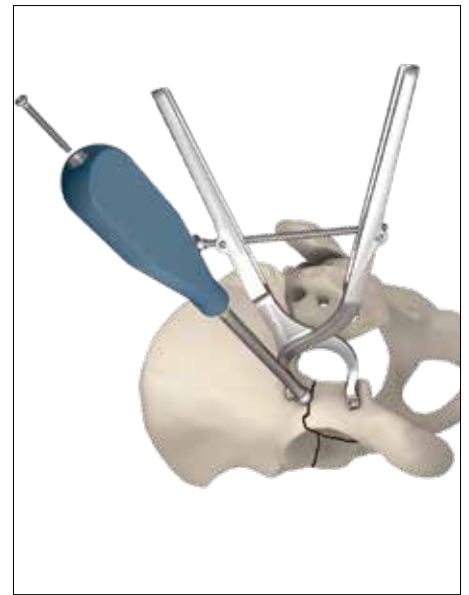
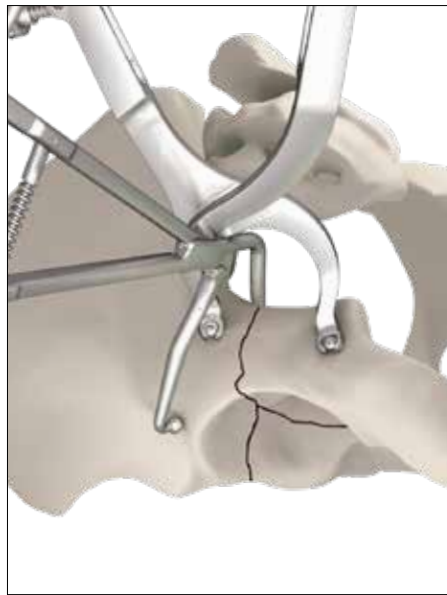
PRO Implant System design

Jungbluth clamps

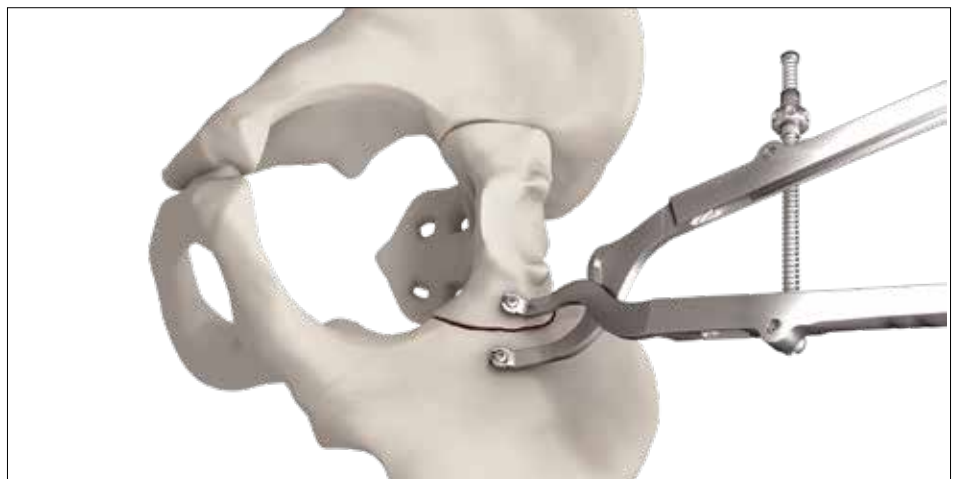
Both Jungbluths in the PRO solution are intended to be used with Ø3.5mm screws. A screw is inserted on each side of the fracture, allowing considerable reduction forces and manipulation in all three planes.



The wide Jungbluth has more clearance between the handles to allow an angled jaw clamp to pass through the greater sciatic notch or to be used in conjunction with the spiked screw inserter.



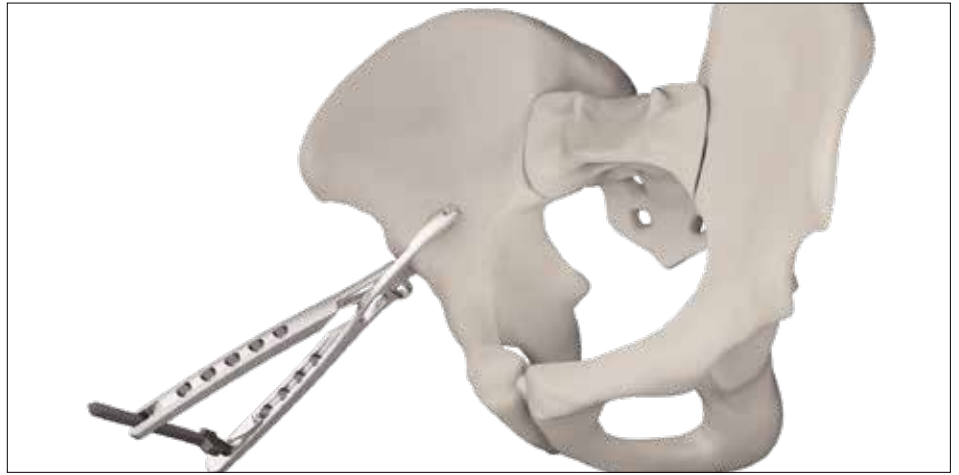
The narrow Jungbluth may be effective in locations where the anatomy and lack of available space preclude the use of the wide Jungbluth.



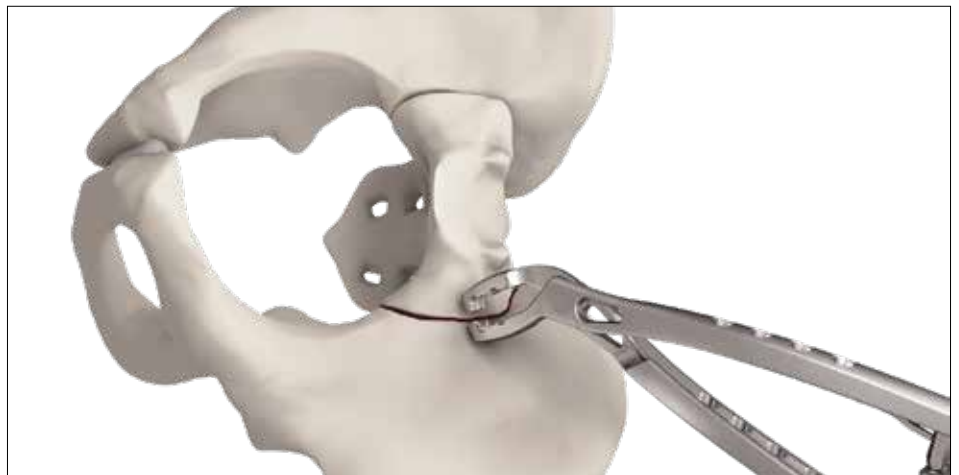
PRO Implant System design

Farabeuf clamps

The Farabeuf may be used for smaller manipulations and fine tuning to grasp fragments or as reduction forceps with provisional Ø3.5mm screws.



The angled Farabeuf is designed to avoid impingement of soft tissues against the handles of the clamp and may be particularly useful during reduction of the sacroiliac joint from an anterior approach.



Both Farabeufs feature a ratchet mechanism that enables compression or distraction settings. Flip the bar labeled "C" to put clamp in compression mode, or reverse it to display "D" for distraction mode.



Distraction

Compression

PRO Implant System design

Additional matta reduction clamps

Verbrugge forceps



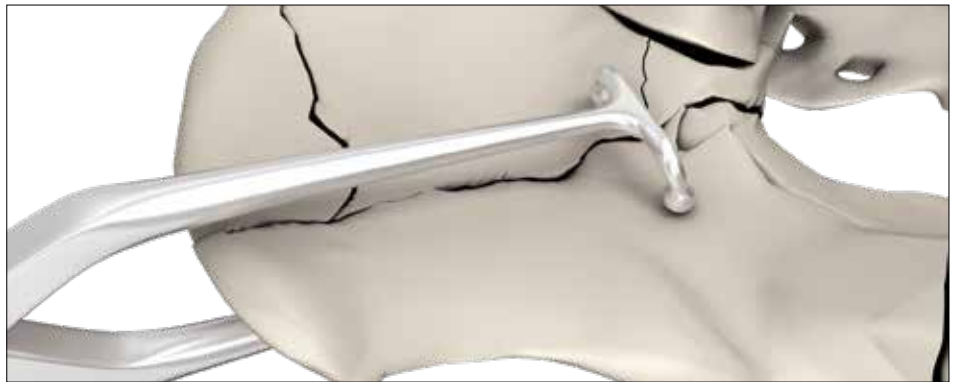
For instances where only one screw is inserted, therefore requiring application of only one jaw, the Verbrugge forceps may be used. The other jaw takes hold of another part of the bony surface.

Reduction forceps, king tong

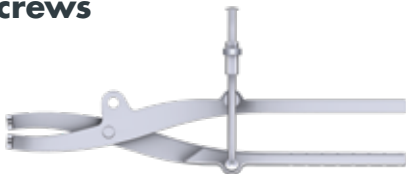


These forceps with three-pointed ball tips allow for reduction of perpendicular fractures. The long handles allow for increased leverage for challenging reductions.

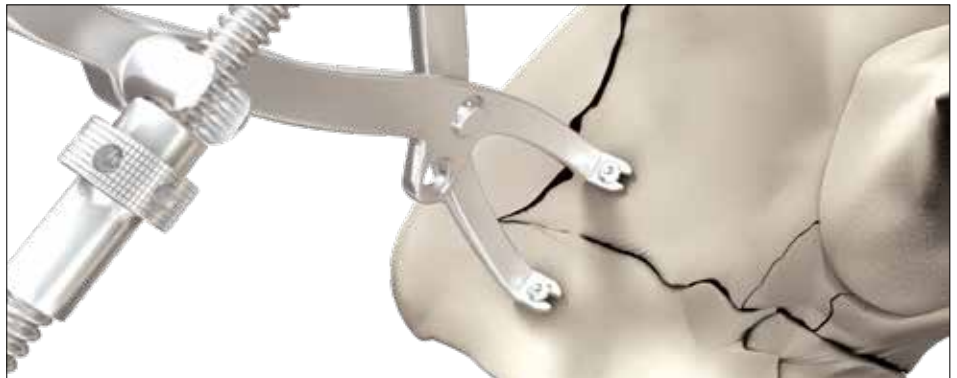
This instrument is available in both a 2x1 and 1x1 jaw version.



Jungbluth for Ø4.5mm screws



If a larger screw is needed, the Matta Jungbluth can accommodate application of a Ø4.5mm screw.



PRO Implant System design

Screw fixation

Washer loading

A washer may be pre-loaded into the Ø3.5mm Spiked screw inserter using the Washer loading stand (b) on the back table.

After drilling and inserting a Ø3.5mm screw, the washer will be deployed with the screw as it passes through the cannula of the instrument.

Ø3.5mm and Ø4.5mm spiked screw inserters

The Spiked Screw Inserters are tools for reduction and placement of independent Ø3.5mm and Ø4.5mm screws.

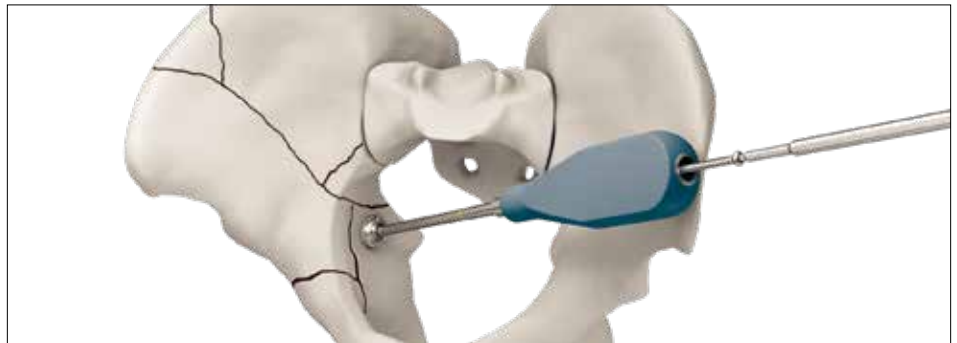
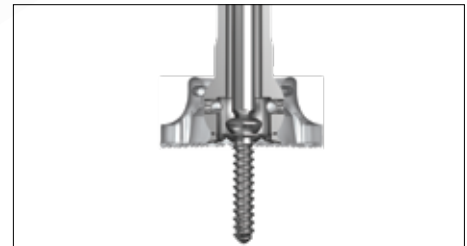
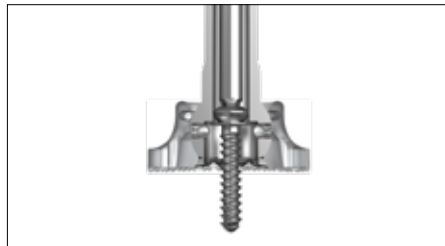
The instruments are cannulated through which a drill sleeve, drill bit, screw, and screwdriver can be passed.

Once drilled, a measurement may be read off the scaled drill bill and the appropriate screw size selected.

The screw may be inserted through the cannulation in the handle followed by the screwdriver. The self-centering design allows the screwdriver to automatically align with the screw head inside the shaft.

Each instrument and accessory is color coded according to screw size. A yellow ring indicates that the instrument is for a Ø3.5mm screw. A black ring indicates that the instrument is for a Ø4.5mm screw.

If more surface area contact or load distribution is desired, the footplate (a) may be attached to the crowned tip of the Spiked screw inserter. This optional attachment includes three hole options for Ø3.2mm K-wire fixation and 20° of angulation.



The washer loading function is only available for Ø3.2mm screws.

⚠ CAUTION

The measurement for correct screw length must be taken with the drill sleeve touching the bone. The measurement is read directly off the drill.

⚠ CAUTION

It is recommended that the Drill Sleeve is inserted into the Spiked Screw Inserter handle outside of the wound, observing it pass beyond the washer to prevent an inadvertent release of the washer into the wound.

PRO Implant System design

Periosteal elevators

Three periosteal elevators are available to aid the dissection and atraumatic exposure of the bone surface in preparation for definitive fixation.

Periosteal Elevator, Straight



The Straight Periosteal Elevator may be used to elevate periosteum and soft tissues from straight bone surfaces.

Periosteal Elevator, Standard



Periosteal Elevator, Reverse



Angled versions may be used to elevate the periosteum and soft tissues from angled bone surfaces such as the ilium and quadrilateral surface.



Anterior Intra-pelvic approach



Ilioinguinal approach



Kocher-Langenbeck approach



Ilioinguinal approach

PRO Implant System design

Plate contouring and bending techniques

The fit of the plate on the bony surface should be as precise as possible, so the insertion of screws will maintain position of the fragments (Fig. 1).

During plating and screw insertion, it is common that the bone is drawn toward the plate and not the plate toward the bone (Fig. 2). Therefore, in certain instances it may be advantageous to contour the plate to a slight mismatch to the bone to aid in obtaining and/or maintaining the optimal reduction.

It is important to utilize the proper instrumentation and bending techniques when manipulating plates. Proper technique may help prevent wedging of the plate by bending tools and weakening of the plate by repeated, corrective contouring.

WARNING

The plate must be shaped correctly to fit the reduced contours of the bone to prevent a fragment from being drawn towards the plate during the tightening of screws.

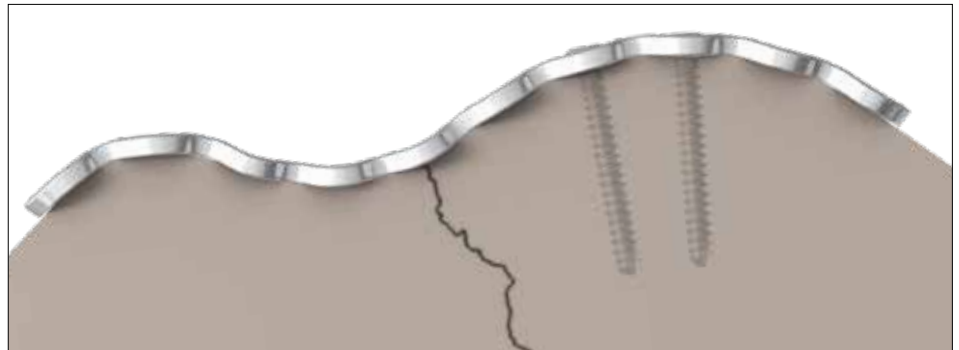


Fig. 1 – correct
If the plate fits precisely.

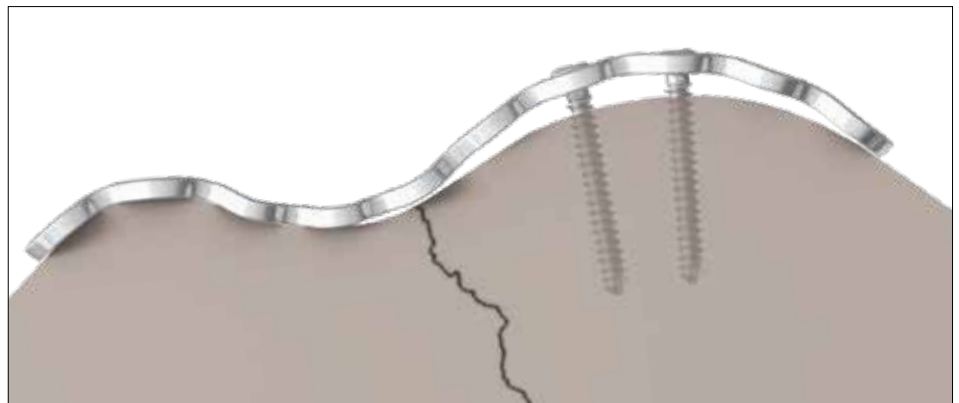


Fig. 2 – incorrect
When tightening the screws, the fragment may be drawn towards the plate.

PRO Implant System design

Plate contouring and bending techniques

PRO plate bender

The PRO plate bender is designed to contour Matta and PRO plates.

Two sides for in-plane curving and the tip for out-of-plane bending provide the surgeon multiple options to contour the plate.

For a plate to fit adequately on a bone, it should be possible to shape it in all directions. Plates may be:

Curved

(Fig. 1a, 1b)

To adapt to the shapes of the pelvis and acetabulum.



Curving (Fig. 1a)



Curving (Fig. 1b)

Bent

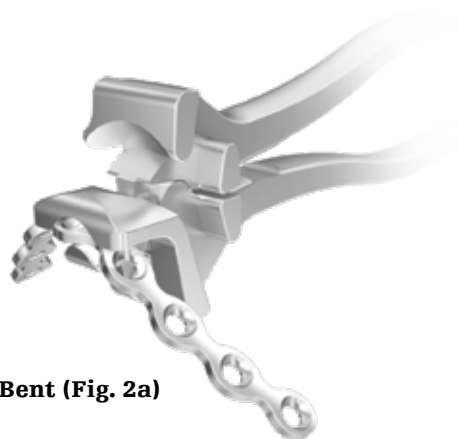
(Fig. 2a, 2b)

Along its main axis.

Twisted

(Fig. 3a, 3b)

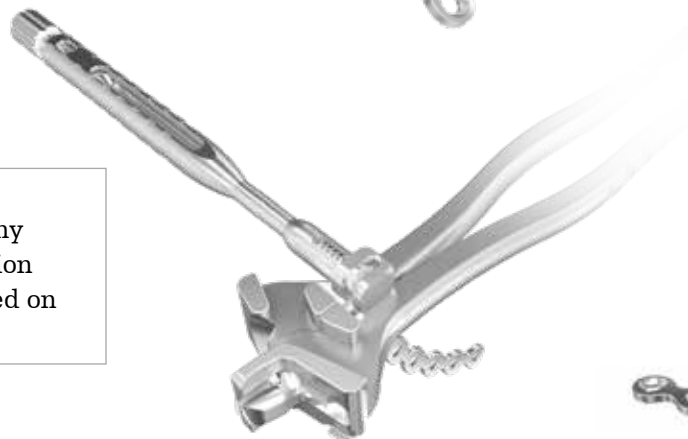
Along its main axis, to give it a helicoidal shape.



Bent (Fig. 2a)



Bent (Fig. 2b)



Twisted (Fig. 3a)



Twisted (Fig. 3b)

⚠ CAUTION

It is not intended to cut any of the plates. All verification testing has been performed on intact plates.

PRO Implant System design

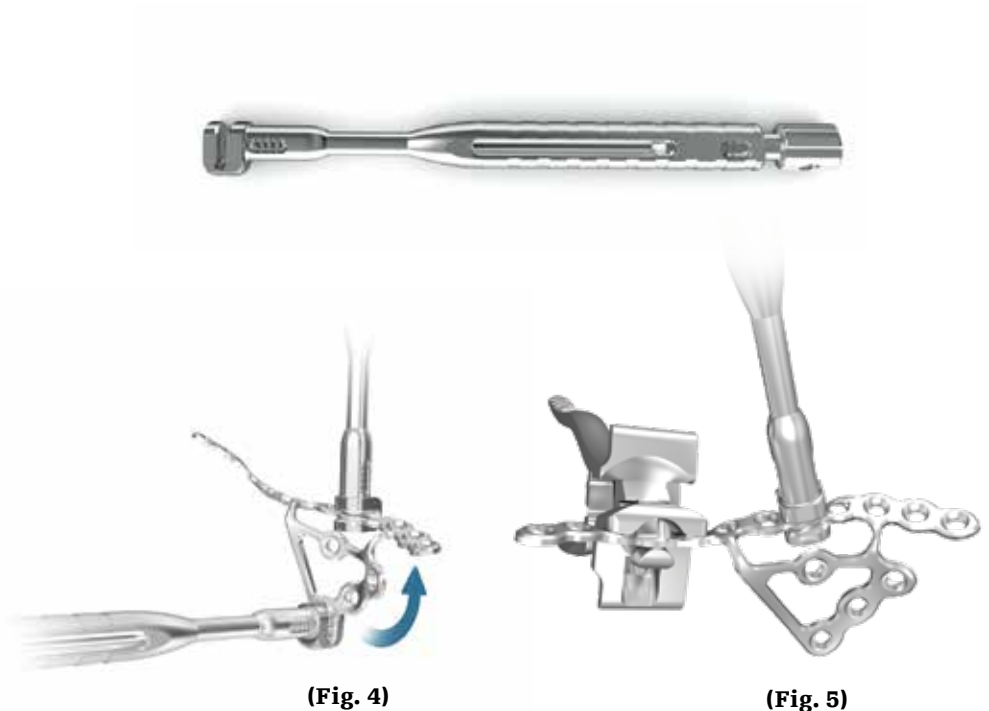
Plate contouring and bending techniques

PRO plate bending holder

The PRO plate bending holder is available to assist with contouring Matta and PRO pelvic plates.

Designed to give the surgeon more control of the bending process and prevent the plate from slipping, this instrument may be useful in adjusting the angle between the two surfaces of the PRO suprapectineal plate (Fig. 4).

This instrument may also be used in conjunction with other bending tools, such as the PRO plate bender to twist or achieve an out-of-plane bend (Fig. 5).



PRO in-situ bender

Two in-situ benders are offered to perform contouring adjustments while the plate is partially fixed to the bone. It has dual functioning ends – one straight and one angled.

The L-extension on the infrapectineal plate is designed to allow the surgeon to use these bending sticks to conform it to the pubic tubercle and place a screw for anterior fixation of the plate (Fig. 6).

⚠ WARNING

Extensive repeated bending of non-annealed Matta Plates can lead to loss of strength. Contouring does not decrease fatigue resistance for annealed Matta Straight Acetabular Plates.



(Fig. 6)

PRO Implant System design

Plate and screw fixation

Handle for plate insertion

The handle for plate insertion may be attached to the PRO QLS plates and/or Matta plates to facilitate plate insertion.

The handle may be attached to any screw hole, depending on the surgeons' needs.



The QLS plates have one dedicated screw hole which is ideal to attach to the plate insertion handle (see blue circles in images to the right). The other screw holes may be used as well, but they are pre-angled so one must note the direction of the pre-angulation when attaching the handle.



PRO Implant System design

Plate and screw fixation

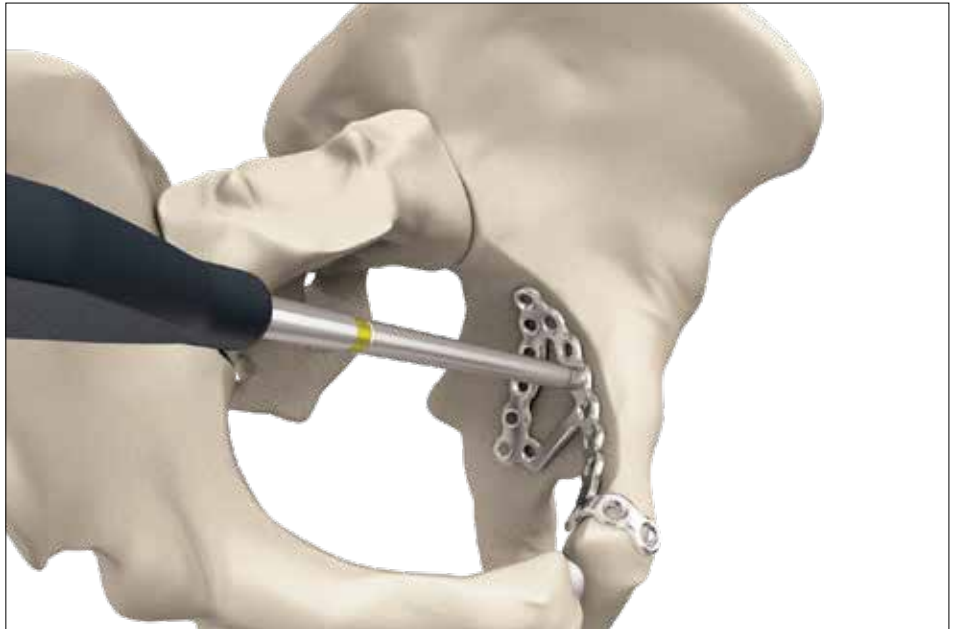
Plate screw inserter

The plate screw inserter allows drilling and screw placement through the plate with one instrument.

The tip of the instrument can swivel in the plate holes to allow accurate placement of screws that need to be angulated.

The plate screw inserter uses the same drill guides, drills and screwdrivers as the spiked screw inserter.

The accessories are color coded, with a yellow ring indicating drill guide, drill and screwdriver for Ø3.5mm screws.



⚠ CAUTION

Take care not to over-angle the drill and drill sleeve beyond the 70° cone (for Ø3.5mm screws).

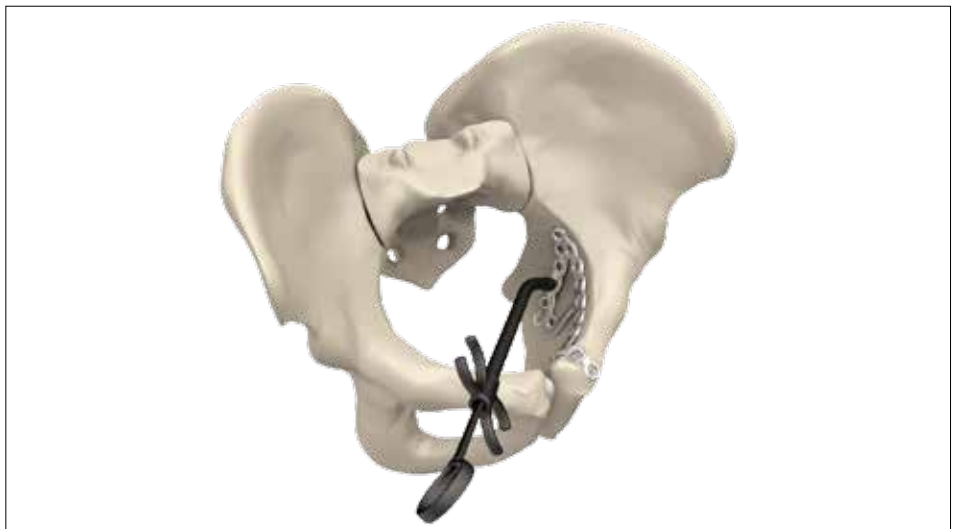
⚠ WARNING

When inserting screws through the Plate Screw Inserter under acute angles, the instrument should be pulled back slightly from the plate before final tightening to allow the screw to be fully seated.

Angled depth gauge

The angled depth gauge offers a design suited for measuring along tangential or angulated drill paths such as the posterior column or quadrilateral surface area. It allows for measurement of screws up to 70mm.

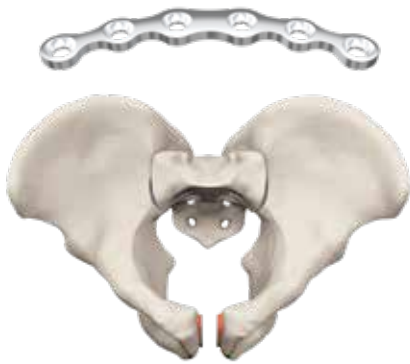
Make sure the metal tip is pulled back (retracted) prior to inserting through the screw hole.



PRO Implant System design

Pelvic ring fracture types and fixation

Pubic symphysis disruption



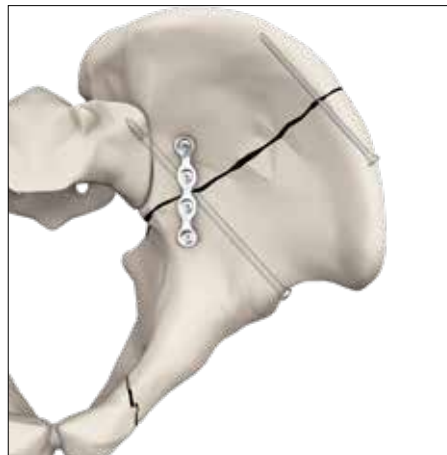
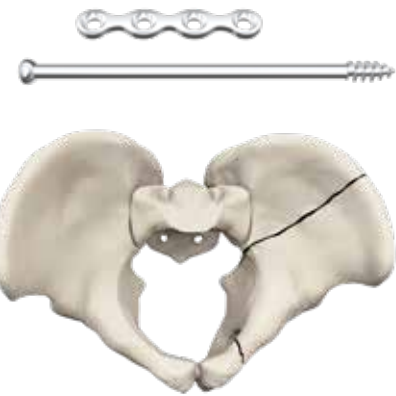
Approach:

The Pfannenstiel approach to the anterior pelvic ring represents a standard for ORIF of a disrupted symphysis pubis.

Fixation:

- Isolated pubic symphysis disruption can be fixed using a dedicated 4 or 6-hole Matta pubic symphysis plate.

Ilium fracture



Approach:

Fractures of the ilium may be reduced and fixed through the lateral window using the ilioinguinal approach or a posterior pelvic ring surgical approach.

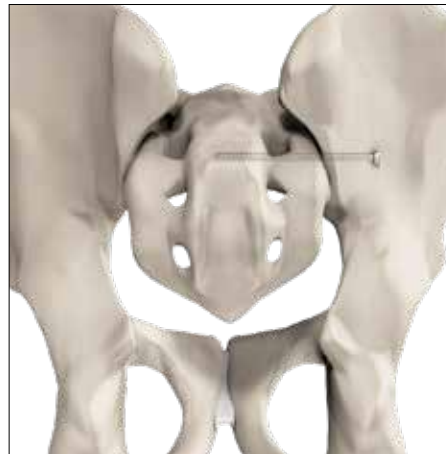
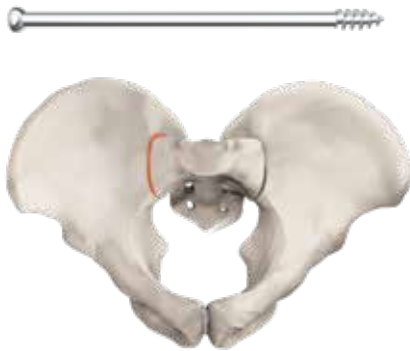
Fixation:

- A screw is inserted from the anterior inferior iliac spine, passing 1cm–2cm above the acetabulum.
- Additionally, an independent lag screw in the iliac crest is placed, starting from the anterior branch.
- A Matta 4-hole straight plate can be used to traverse the fracture line in the area of the pelvic brim.

PRO Implant System design

Pelvic ring fracture types and fixation

Sacroiliac dislocation



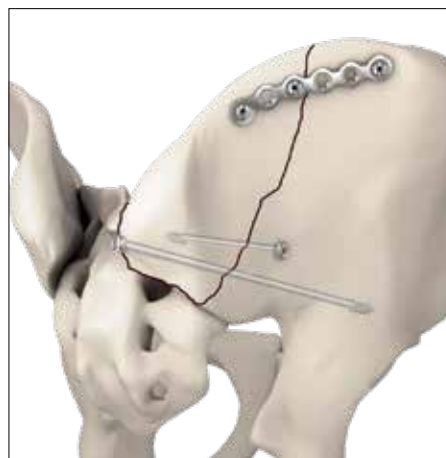
Approach:

Sacroiliac dislocations may be reduced and fixed through an anterior or posterior pelvic ring surgical approach.

Fixation:

- An Asnis III cannulated iliosacral screw may be used for fixation of dislocation.

Sacroiliac fracture / dislocation



Approach:

Sacroiliac fracture dislocations may be reduced and fixed through a posterior pelvic ring surgical approach.

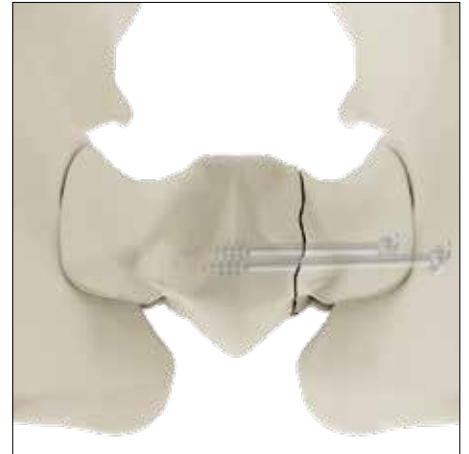
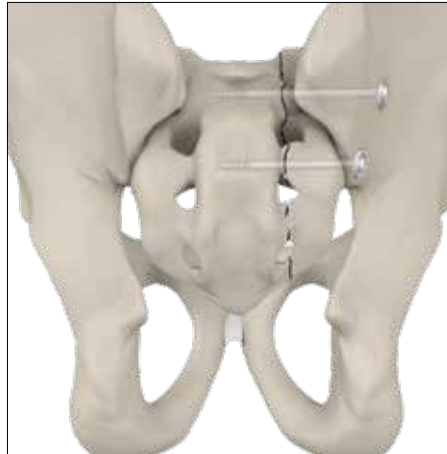
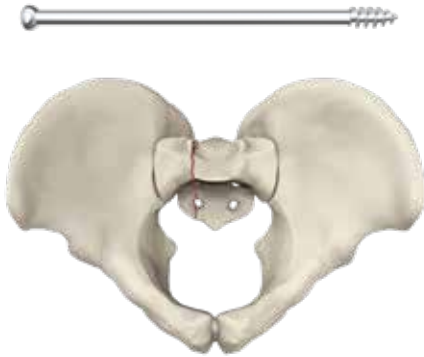
Fixation:

- An independent lag screw is placed starting from the posterior-inferior iliac spine to stabilize the reduction of the inferior aspect of the iliac wing
- A 6-hole Matta flex plate stabilizes the reduction of the iliac crest.
- An Asnis III cannulated iliosacral lag screw fixes the sacroiliac joint.

PRO Implant System design

Pelvic ring fracture types and fixation

Sacrum fracture



Approach:

Sacrum fractures may be reduced and fixed through a posterior pelvic ring surgical approach.

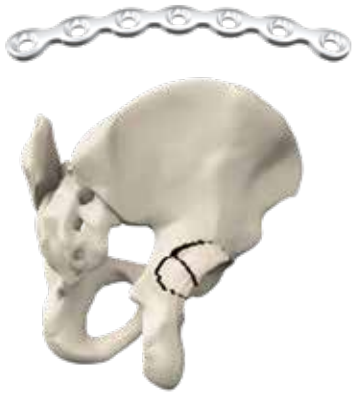
Fixation:

- A sacrum fracture may be fixed with two Asnis III cannulated lag screws.
- Alternatively a Ø6.5mm cancellous screw may be placed into the S1 or S2 vertebral bodies through the lateral iliac wing.

PRO Implant System design

Acetabular fracture types and fixation

Posterior wall



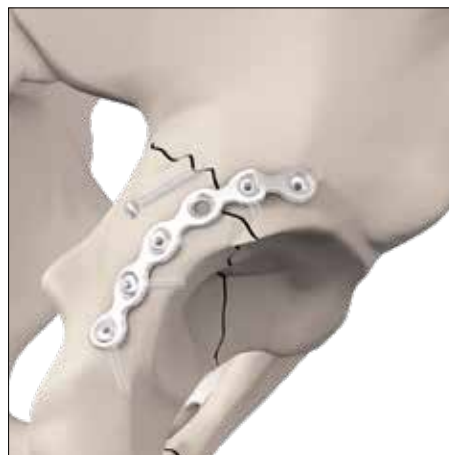
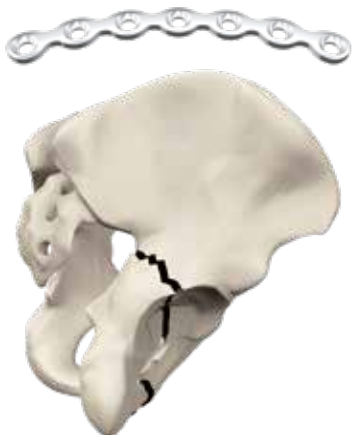
Approach:

Posterior wall fractures may be reduced and fixed using the Kocher-Langenbeck approach.

Fixation:

- Two independent lag screws initially fix the fragments with the desired anatomical reduction.
- A 6 or 7-hole Matta curved R108 plate or alternatively an 8-hole Matta flex plate may span the fragments along its axis and serve as a neutralization plate.

Posterior column



Approach:

Posterior column fractures may be reduced and fixed using the Kocher-Langenbeck approach.

Fixation:

- Definitive fixation can be started with an independent lag screw from the distal fragment into the posterior buttress of the Ilium.
- To maintain the reduction, a 6-hole Matta curved plate or 8-hole Matta flex plate may be used along the acetabular margin.

⚠ CAUTION

All central screws should be perpendicular to the quadrilateral surface to avoid penetration of the hip joint.

PRO Implant System design

Acetabular fracture types and fixation

Anterior wall



Approach:

Anterior wall fractures may be reduced and fixed using the ilioinguinal approach.

Fixation:

- One or two independent lag screws fix the reduced fragments.
- A Matta curved plate bridges the fragment on the pelvic brim from the iliac fossa to the intact part of the pubic ramus.

Anterior column



Approach:

Anterior column fractures may be reduced and fixed using the ilioinguinal or anterior intrapelvic approach.

Fixation:

- An independent lag screw maintains the reduction.
- A 10-hole Matta curved plate is shaped to adapt it to the pelvic brim from the pubic tubercle to the vicinity of the sacroiliac joint.
- A minimum of two screws should be placed beyond the fracture line.
- Alternatively, the PRO suprapectineal quadrilateral surface plate may be used.

PRO Implant System design

Acetabular fracture types and fixation

Transverse



Approach:

The Kocher-Langenbeck approach is typically used to access transverse fractures. Alternatively, they may be accessed anteriorly using the ilioinguinal or anterior intrapelvic approach.



Posterior fixation:

- Through the Kocher-Langenbeck approach, the posterior column is stabilized with an independent lag screw.
- A 6-hole Matta curved plate may serve as a neutralization plate.

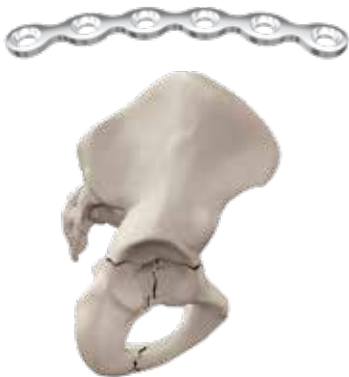


- The anterior column is stabilized with an independent lag screw.

Anterior fixation:

- Through the ilioinguinal or anterior intrapelvic approach, the PRO suprapectineal or infrapectineal quadrilateral surface plate may be used.

T-shaped



Approach:

A Kocher-Langenbeck approach is frequently used to perform an ORIF of a T-shaped fracture. In some circumstances, combined anterior and posterior approaches or an extended ilio-femoral approach may be necessary.



Posterior fixation:

- Through the Kocher-Langenbeck approach, the posterior column is stabilized with an independent lag screw.
- A Matta curved or flex plate may serve as a neutralization plate.



- The anterior column is stabilized with an independent lag screw.

Anterior fixation:

- Through the ilioinguinal or anterior intrapelvic approach, the PRO suprapectineal or infrapectineal quadrilateral surface plate may be used.

PRO Implant System design

Acetabular fracture types and fixation

Transverse and posterior wall



Approach:

Combined transverse and posterior wall fractures may be reduced and fixed using the Kocher-Langenbeck approach.

Fixation:

- Two independent lag screws stabilize the transverse fracture component.
- One or two independent lag screws maintain the reduction of the posterior wall fragment.

- A Matta 8-hole flex plate or alternatively, a 6 or 7-hole Matta curved plate is applied to buttress the posterior wall.

Posterior column and posterior wall



Approach:

Combined posterior column and Posterior Wall fractures may be reduced and fixed using the Kocher-Langenbeck approach.

Fixation:

- Initial fixation of the posterior column with an independent lag screw and / or a 5 or 6-hole Matta curved plate.
- If the posterior wall fragment is large enough, it should be attached to the column with one or two lag screws.

- Definitive stabilization of the posterior wall and column with a 7 or 8-hole Matta curved plate, buttressing the posterior wall and anchoring securely to the ilium and ischium with cortical screws.

PRO Implant System design

Acetabular fracture types and fixation

Both column



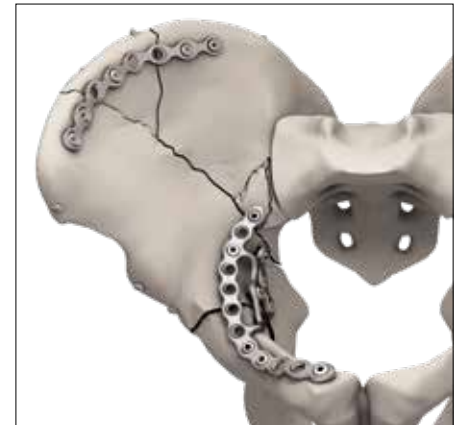
Approach:

Both column fractures may be reduced and fixed using the iliofemoral, extended iliofemoral, or anterior intrapelvic approach.



Fixation:

- Two independent lag screws in the iliac crest stabilize the iliac wing fracture fragments.
- One or two independent lag screws running from the upper aspect of the true pelvis can fix the posterior column.
- One independent lag screw can fix the separated posterior fragment of the pelvic brim just lateral to the sacroiliac joint.

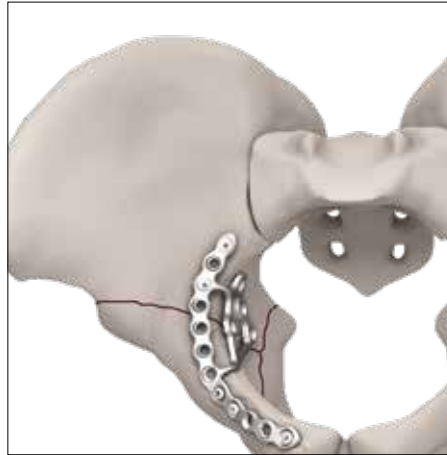
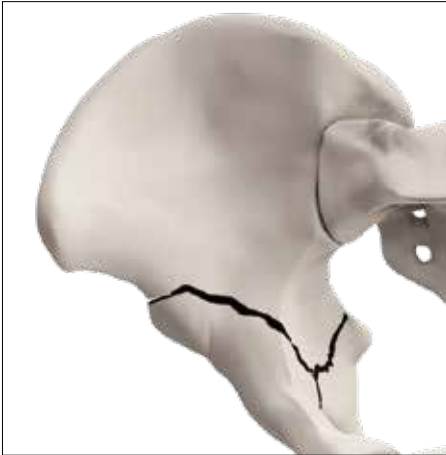


- An 8-hole Matta flex plate may be placed along the iliac crest to stabilize the iliac wing fracture.
- A 10 or 12-hole Matta curved plate along the pelvic brim can stabilize the anterior column.
- Alternatively, a PRO suprapectineal quadrilateral surface plate may be used.

PRO Implant System design

Acetabular fracture types and fixation

Anterior column and posterior hemi-transverse



Approach:

Anterior column/posterior hemi-transverse fractures may be reduced and fixed using the ilioinguinal approach or anterior intrapelvic approach.

Anterior column reduction:

Reduction typically starts with the anterior column.

Anterior column fixation:

Stabilization of the anterior column typically starts peripherally with the iliac crest and can be achieved with either plates or screws. This may be augmented by a buttress plate placed along the pelvic brim, extending from the area lateral to the sacroiliac joint to the superior pubic ramus.

In some cases, it is possible to achieve stable fixation with a lag screw technique alone.

Posterior column reduction:

Once the anterior column is reduced and provisionally stabilized, the posterior column can be addressed.

Posterior column fixation:

Fixation of the posterior column is typically provided by lag screws or position screws, which are inserted from the pelvic brim into the safe zone that extends from the cranial limit of the greater sciatic notch distally to the ischium, depending on the starting point.

Pelvic buttress plate:

A PRO suprapectineal plate can be placed on the quadrilateral surface to buttress comminution or counteract posterior column medial displacement.

In addition, one or two independent lag screws can be placed in the posterior portion of the plate.

CAUTION

Take care to avoid penetration of the hip joint when independent lag screws are placed in the posterior portion of the plate.

PRO Implant System design

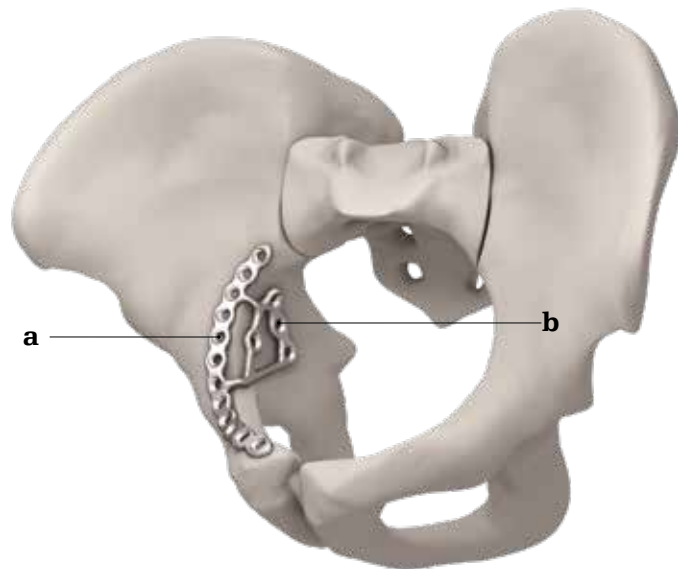
Suprapectineal plate technique

Suprapectineal plate

The suprapectineal quadrilateral surface plate was designed with a specific fracture pattern in mind: specifically, in situations where the anterior column is disrupted and the quadrilateral surface is comminuted and disassociated from the posterior column – such as the anterior column posterior hemitransverse.

The important feature of this plate is that it provides simultaneous fixation in both the anterior and posterior columns. It buttresses the anterior column with the suprapectineal portion of the plate (a), and the quadrilateral surface with the infrapectineal portion (b).

Therefore, in order for this plate to function optimally, it must be in intimate contact with both surfaces (anterior column and quadrilateral surface) simultaneously.



WARNING

Always properly reduce the fracture and stabilize with reduction clamps and/or lag/position screws prior to the placement of the plate, as it is not a reduction tool.

WARNING

Always carefully apply the plate in such a way that when the first screw is placed into a hole on one of the surfaces that the plate does not come away from the other surface.

The following technical suggestion is one possible way to avoid this occurrence.

First, use the plate insertion handle to hold the plate by the central hole and apply a laterally directed force to ensure that the plate is flush against the quadrilateral surface.

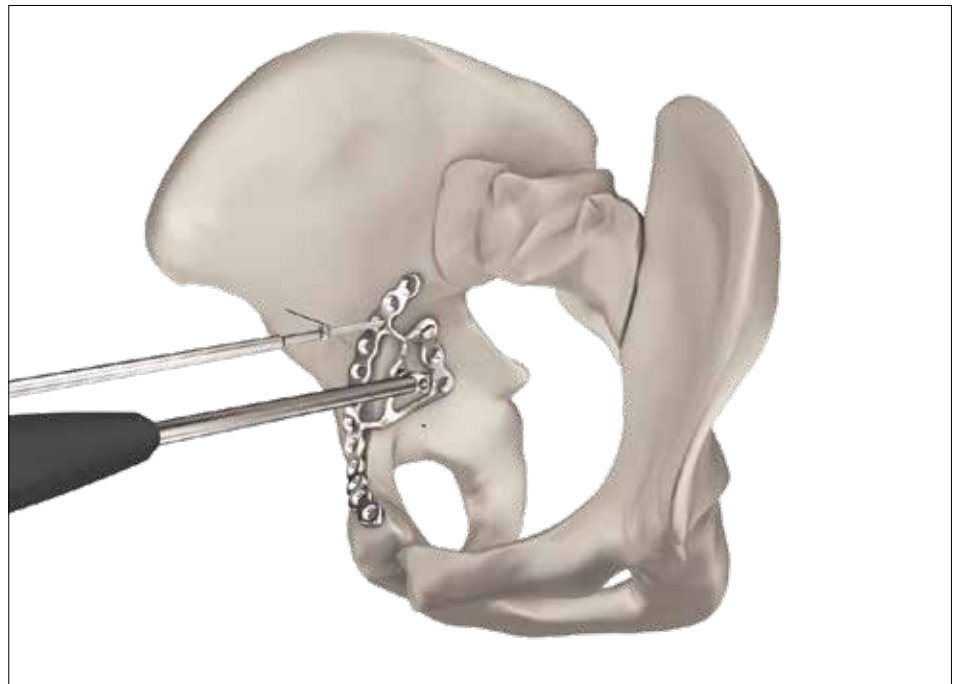
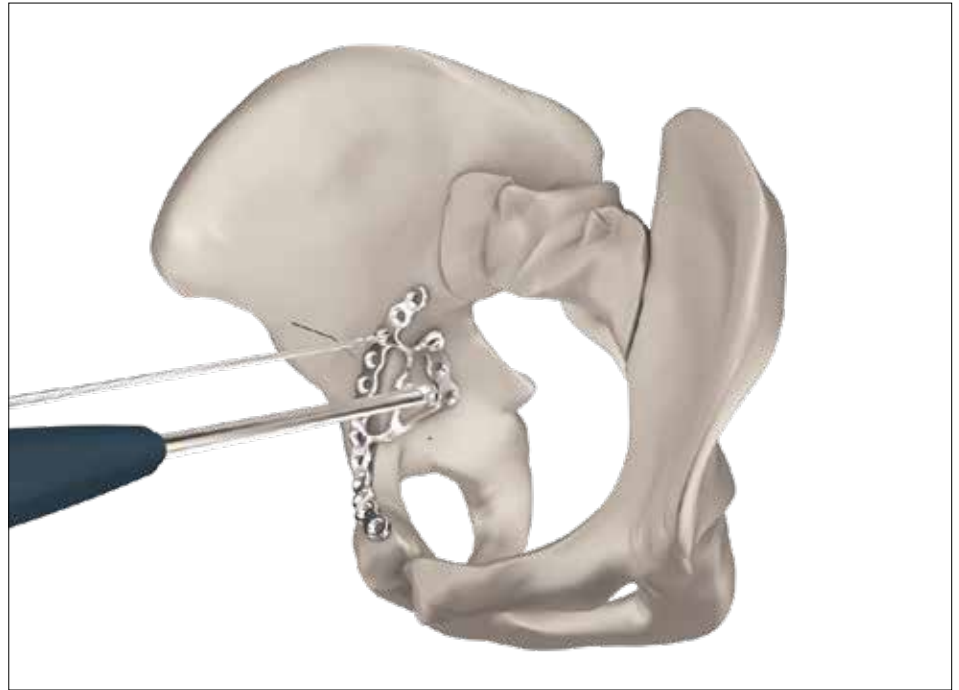


PRO Implant System design

Suprapectineal plate technique

Next, using a Ø2.5mm drill bit, drill eccentrically in the hole opposite the posterior arm of the plate and place a Ø3.5mm screw into the suprapectineal portion.

This will simultaneously bring the plate down onto the anterior column and lateralize the plate to further ensure that good contact is made between the plate and both surfaces.



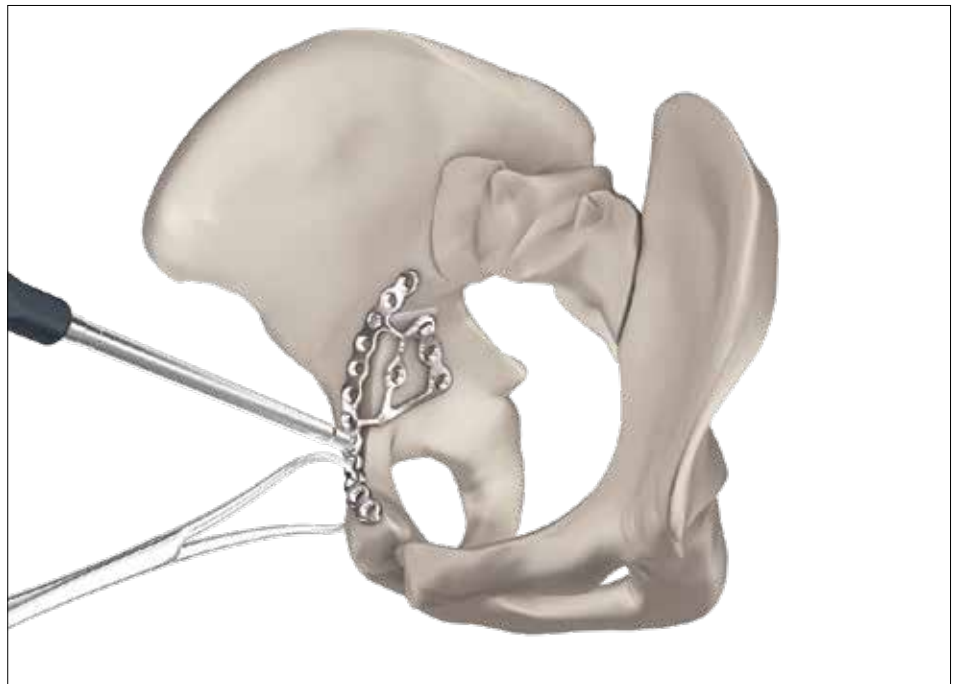
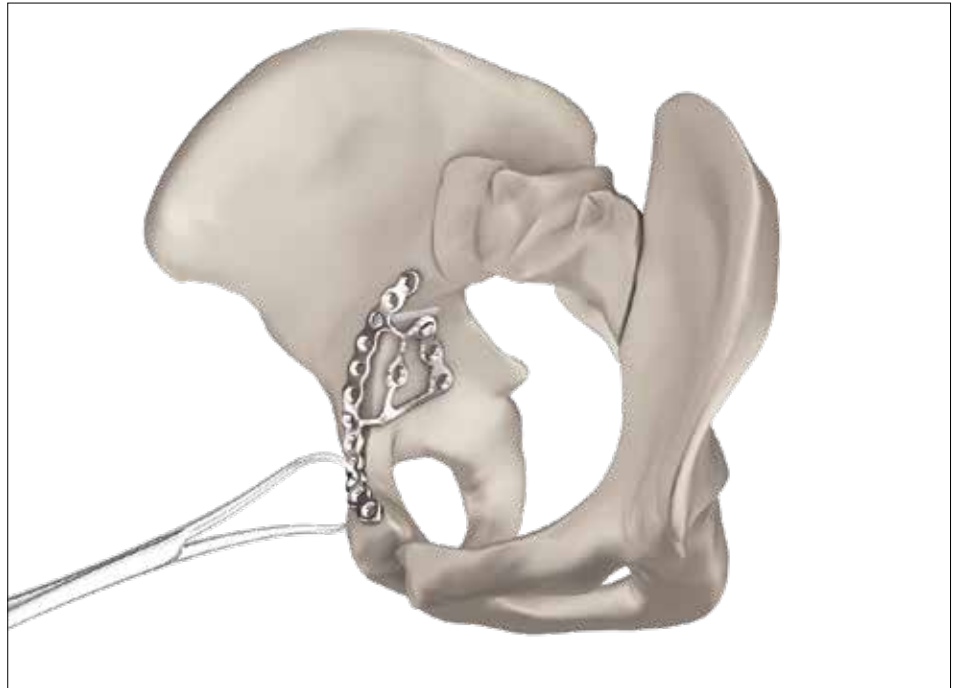
PRO Implant System design

Suprapectineal plate technique

Prior to insertion of any more screws, the surgeon must ensure that the plate is rotated and aligned correctly with the anterior aspect of the pelvis.

At this stage, with only one point of fixation in the posterior aspect of the plate, the plate can still be fine-tuned or adjusted to align with the anterior pelvis without affecting the reduction. A small reduction clamp can be placed onto the plate to bring it down to the pubic body.

A screw is then placed through the plate into the superior pubic ramus followed by the pubic body to secure the anterior portion of the plate to the anterior column in a buttress fashion and maintain the rotation.



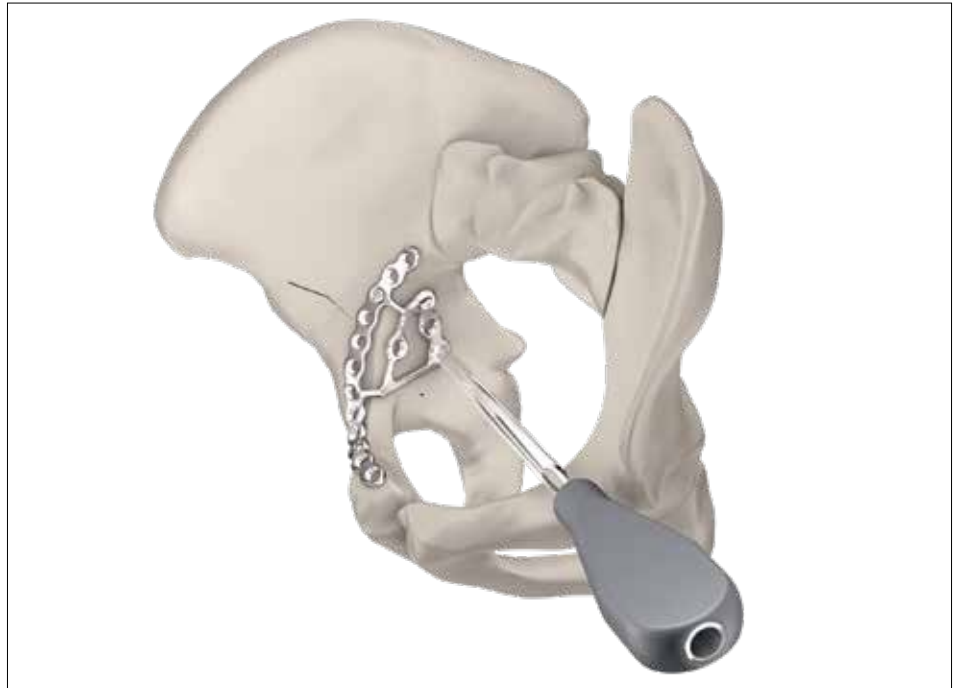
PRO Implant System design

Suprapectineal plate technique

Next, the infrapectineal portion of the plate is anchored to the posterior column. It is important to use a screw hole that is as far distal on the infrapectineal portion of the plate as possible since this will help to ensure that maximal plate surface area contact is achieved to optimally buttress the quadrilateral surface.

The plate screw inserter will help to facilitate placement of this screw deep in the base of the wound.

At this point the three key aspects of the plate have been secured to their respective anchor points in the anterior column, innominate bone, and posterior column, thus maintaining firm contact with the anterior column and quadrilateral surface.



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