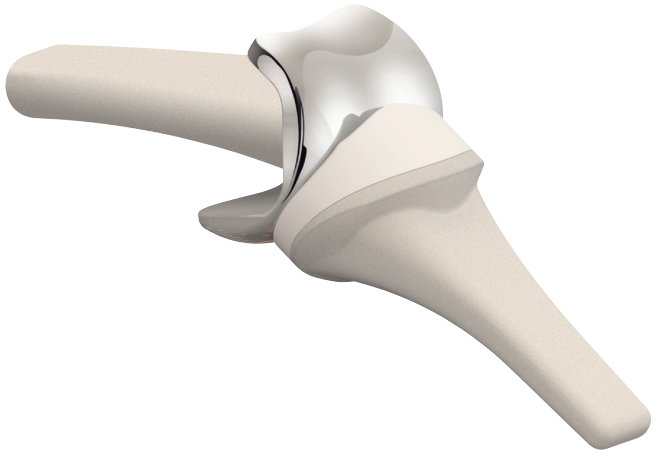
MatOrtho®

PIPR™
Proximal Interphalangeal Replacement
Operative Technique



Forever **Active**

PIPR™ Proximal Interphalangeal Replacement

Developed in association with Mr I Trail and The Wrightington Hospital.

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Acknowledgements:

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Manufactured by Mat**Ortho** Limited

13 Mole Business Park | Randalls Road | Leatherhead | Surrey | KT22 7BA | United Kingdom

T: +44 (0)1372 224200 | info@Mat**Ortho**.com

For more information visit: www.Mat**Ortho**.com

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System Rationale

The PIPR™ has been designed to replace the proximal interphalangeal joints in the hand. Developed between 2002 and 2006, the PIPR™ is the result of extensive research and accurately mimics the kinematics of a healthy PIP joint. The PIPR™ achieves good function through preservation of functioning collateral ligaments and with conforming anatomical bearing design. A size range with limited interchangeability and advanced instrumentation are provided to ensure good fit and aid ligament balancing for joint stability.

The PIPR™ was first used in January 2006 at the the Wrightington Hospital, UK and to date more than 200 have been implanted. The PIPR™ has been demonstrated to improve pain, function and range of movement.

Key features include:

- The design of the bearing geometry is based on extensive anatomical research
- The polyethylene bearing insert is provided pre-assembled with the middle stem and is designed to permit final rotational alignment on joint reduction for improved range of motion and implant longevity (through reduction of contact stresses)
- The coupling of the polyethylene insert enables normal functional rotation as exhibited by a healthy PIP joint
- Stem geometries are based on normal anatomy
- The patented Co-Cr middle component design is designed to preserve the collateral ligament attachments so that joint stability is not compromised
- The PIPR™ is a cementless device, with precise instrumentation to provide a press-fit, and with HA coating to expedite bone integration
- The system allows the middle component to be downsized when required
- Advanced instrumentation is provided to generate accurate bone cuts and allow balancing of the joint throughout flexion so that the surgeon can ensure stability is provided by the collateral ligaments

Indications

- Any patients suffering from significant pain and discomfort that cannot be controlled by conservative means
- Any patients suffering from inflammatory arthritis
- Any primary or secondary osteoarthritic patients
- Any signs of significant arthritis, but minimal bone loss, on X-ray

Contraindications

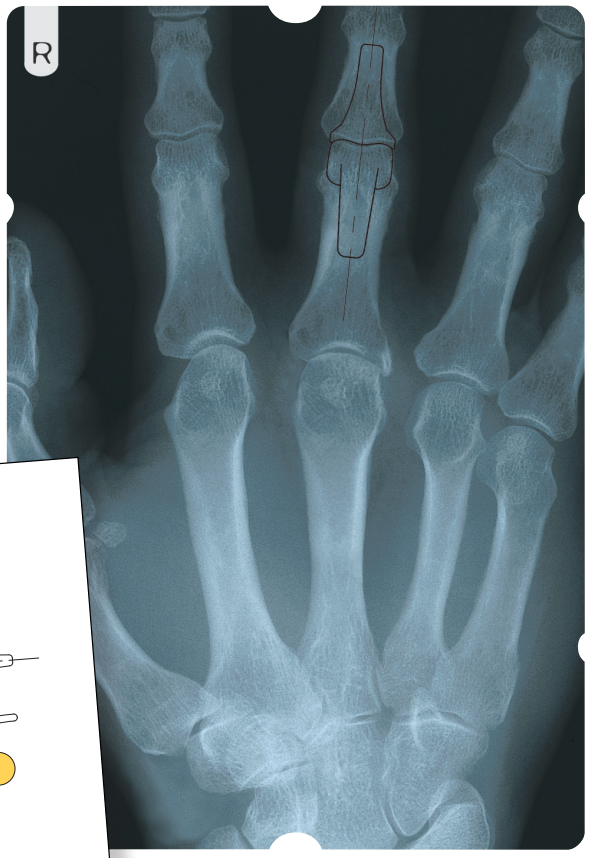
- Any form of previous or current infections of the hand
- Soft tissue deficiencies causing gross instability or gross deformity
- Compromised collateral ligaments
- Inadequate bone stock

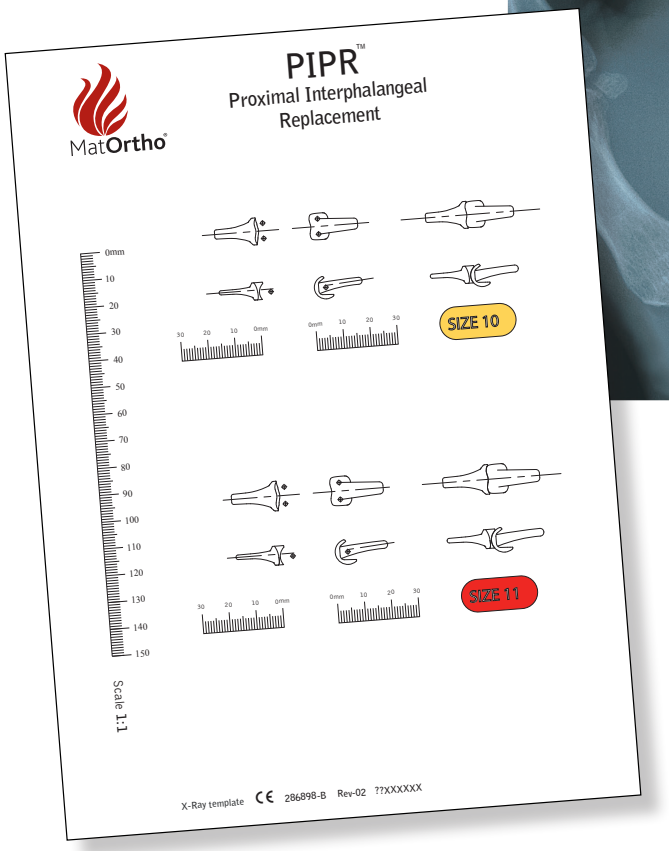
Step 1

An X-ray assessment should be made within the three months before the operation which shows an A-P and true lateral of the involved fingers.

Using the MatOrtho® PIPR™ X-ray template at 3% magnification, assess the size of the prosthesis in the dorsal/palmar view.

Note that the final size of the implant components will be determined by the rasping instruments and trial components.





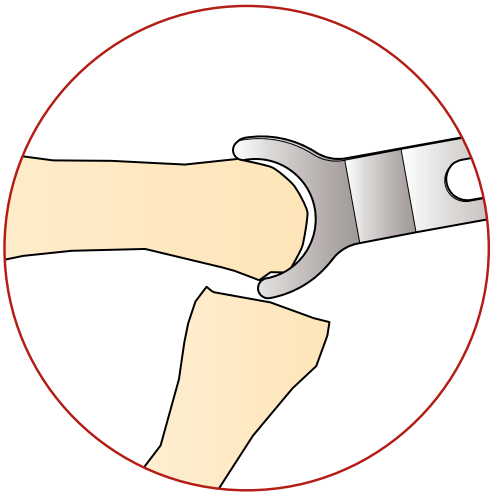
Step 2

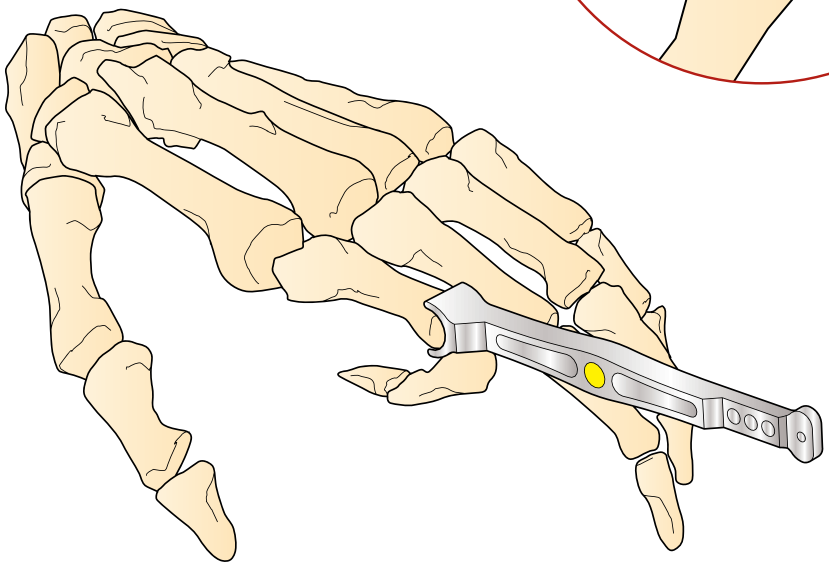
Surgical Exposure and Templating

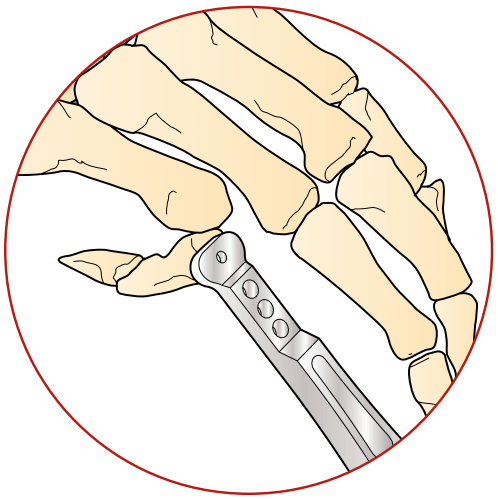
A dorsal curved incision is recommended. Thereafter there is a longitudinal incision of the extensor tendon releasing the central slip and retracting the split extensor tendon in a radial ulna direction. This should allow exposure and indeed dislocation, of the proximal interphalangeal joint.

The Sizing Template is then used to assess the appropriate size of implant. Starting with one of the smaller templates, attempt to fit the forked end, which represents the maximum diameter in the lateral view of the head of the Proximal Component, around the condyles on the head of the Proximal Phalanx. Repeat using successive sizes until identifying the Template which provides the best fit over both condyles.

The flat end of the Template can be used to assess the fit of the Middle Component on the base of the Middle Phalanx.







Step 3

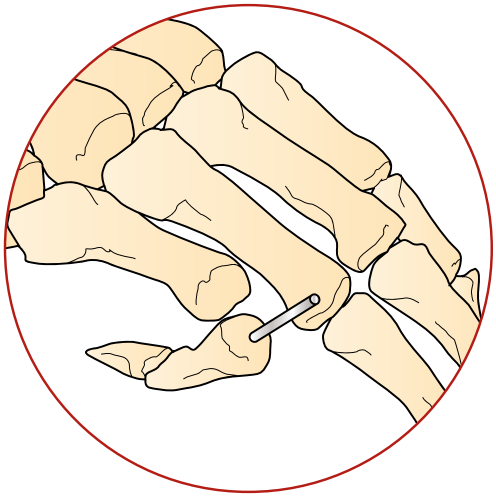
Position the Guide Pin in the Middle Phalanx

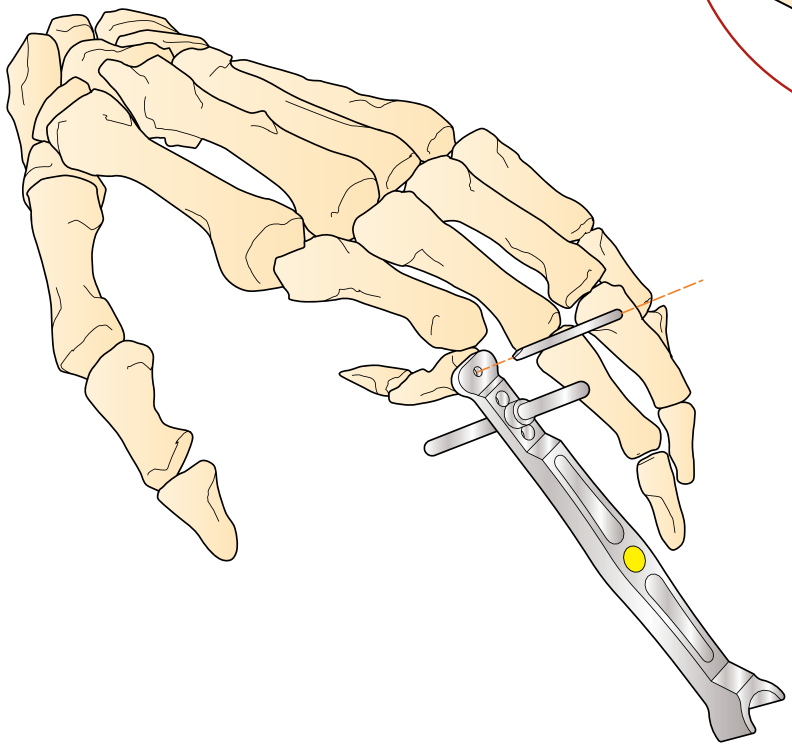
Insert the 1.8mm Guide Pin into the articular surface of the Middle Phalanx, to a depth of between 10mm and 20mm. The entry point should be carefully positioned to achieve centralisation of the Pin into the Middle Phalanx shaft, both in dorsal/palmar and lateral orientation. The Pin should also be aligned with the central axis of the Middle Phalanx shaft.

The Sizing Template may be used to aid positioning and alignment of the Pin.

Using the Sizing Template: Insert the Template Alignment Rod into one of the three larger holes in the Template and place the flat end of the Template on the base of the Middle Phalanx. Adjust the position of the Template to align the small hole at its end with the centre of the Phalanx shaft. Carefully align the Template Alignment Rod along the Phalanx shaft and insert the 1.8mm Guide Pin into the Phalanx using the small hole in the Template as a guide. Once the Pin is in place the Sizing Template can be carefully removed.

The position and alignment of the Pin should be verified radiologically.





Step 4

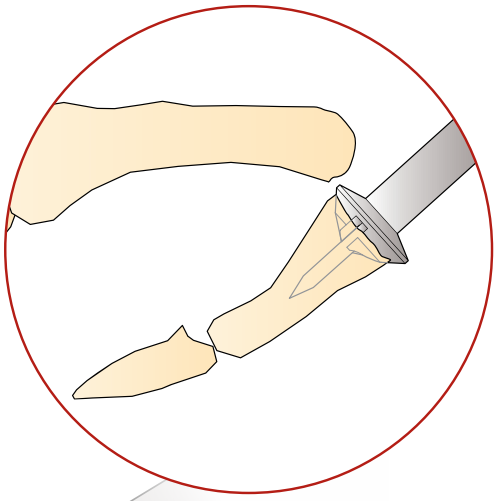
Prepare for Milling

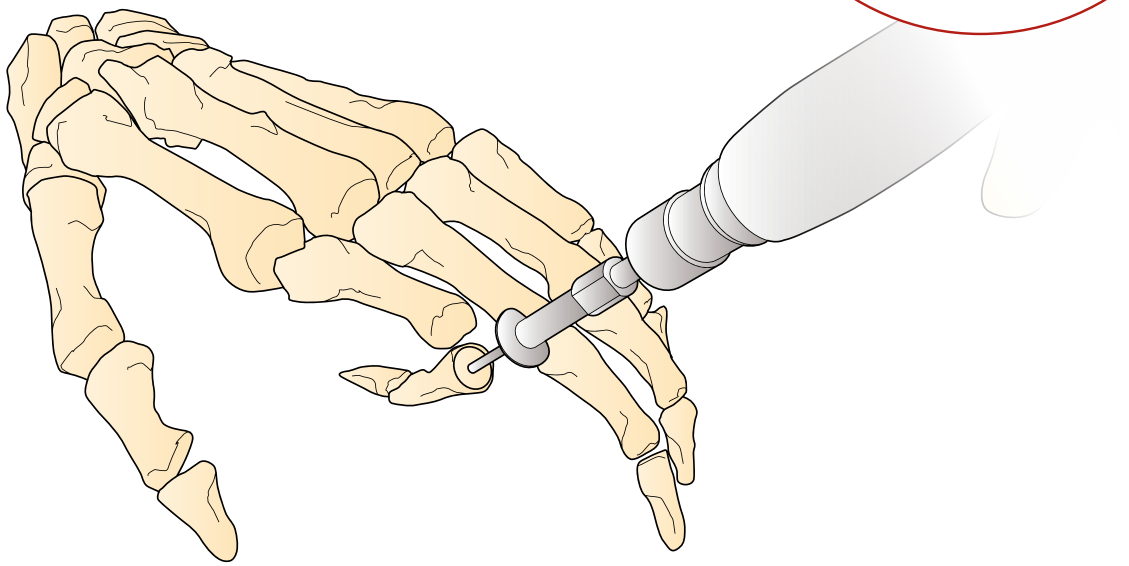
Assess the size of the Conical Mill required prior to milling (the nominal sizes correspond to the overall width of the implants).

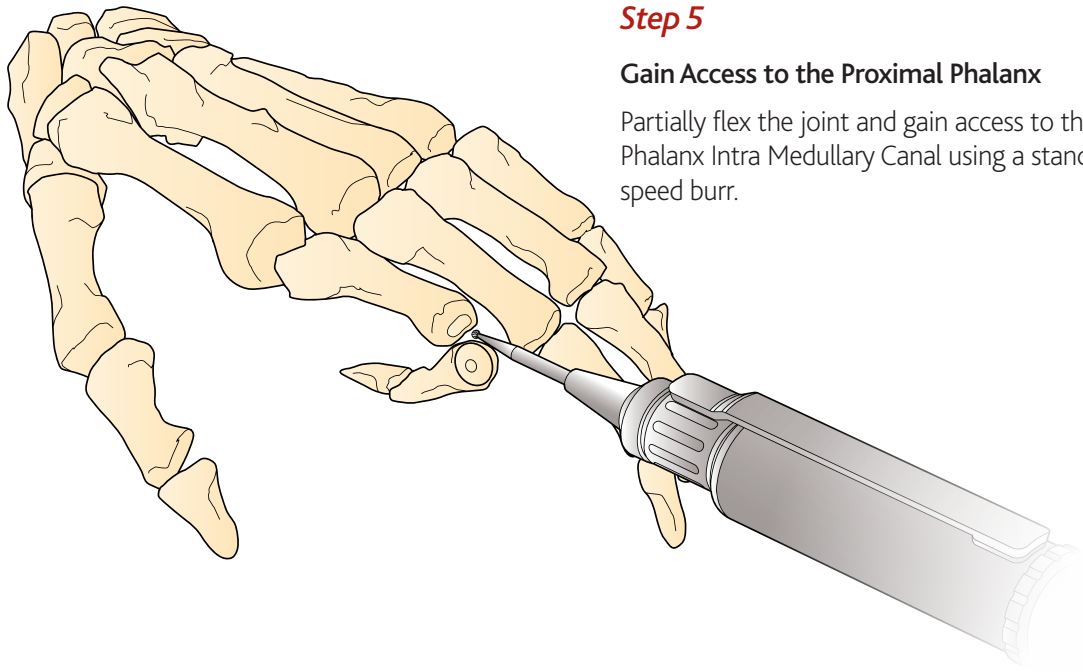
Select the chosen size Conical Mill, mount it in a power drive and slide over the 1.8mm Guide Pin until it meets the articulating surface.

Advance the Conical Mill to just before mill depth taking great care to preserve the collateral ligament attachments.

When milling is completed, both the Mill and Guide Pin can be removed.







Step 5

Gain Access to the Proximal Phalanx

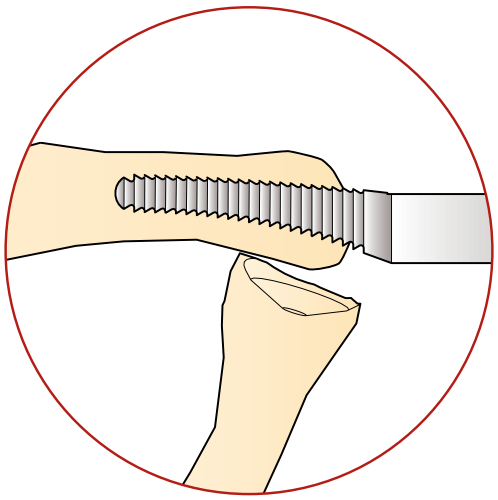
Partially flex the joint and gain access to the Proximal Phalanx Intra Medullary Canal using a standard high speed burr.

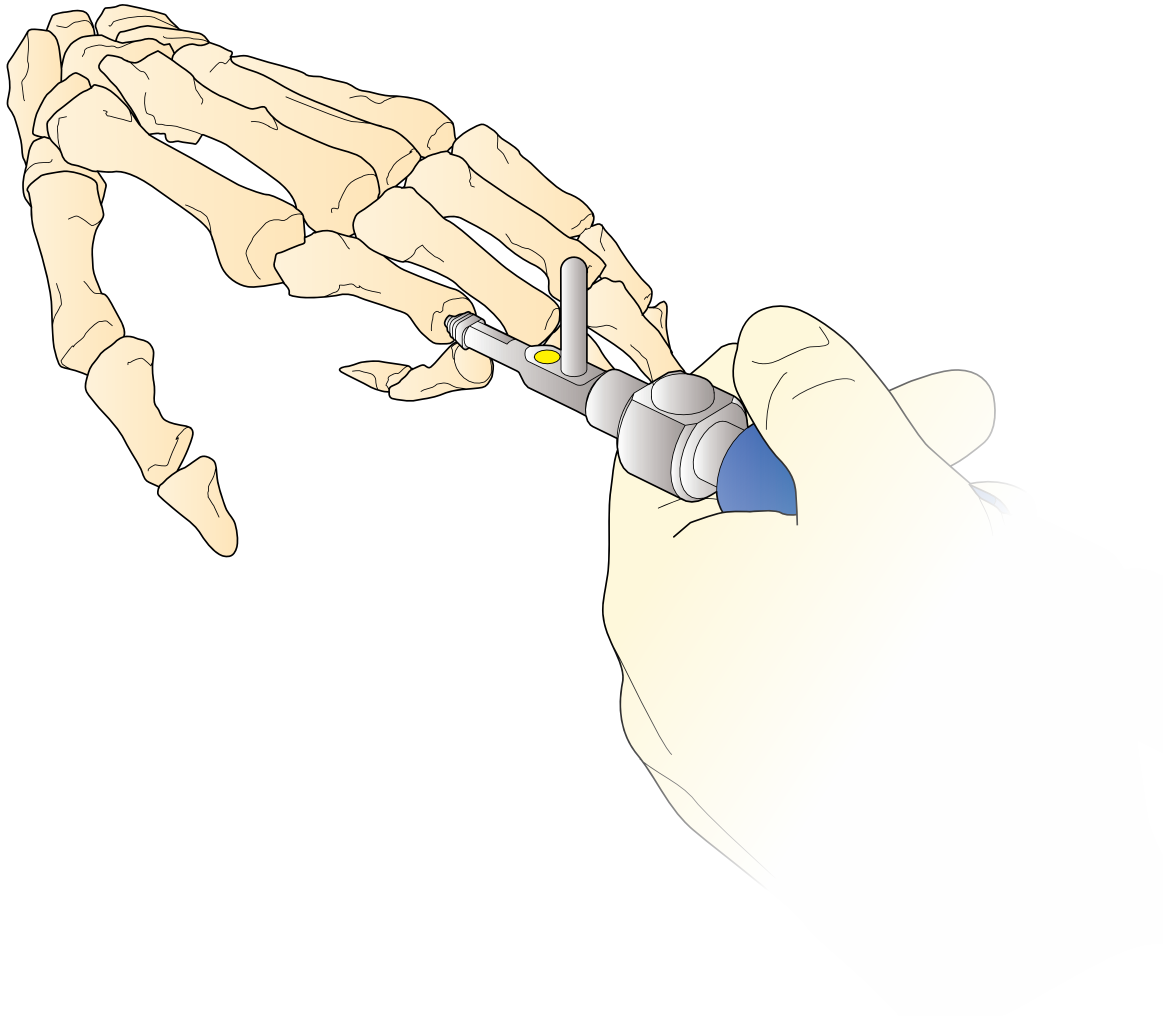
Step 6

Rasping the Proximal Phalanx

Select a Proximal Rasp one size smaller than the templated final size and assemble together with the Instrument Handle and Rasp Alignment Guide (if required). Work the Rasp into the cavity, backing- off regularly to clear debris, until there are two teeth showing outside the bone; this stage can be facilitated by using a power burr.

Assess the fit and fill and, if necessary, progress to the next size Rasp. Record the final size Rasp used (P7, P8, P9, P10, P11).This will indicate the Proximal Component size.





Step 7

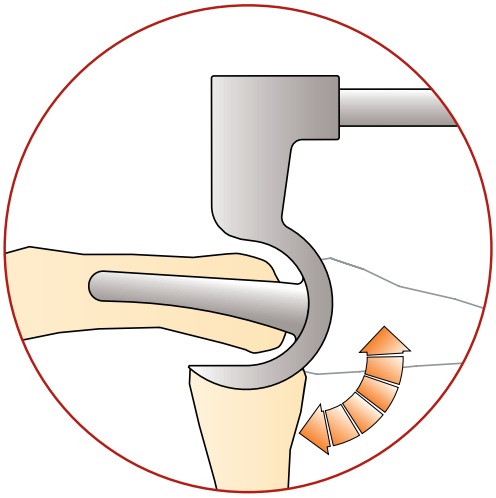
Check the Flexion and Extension Gaps

Fully insert the appropriate sized Balancing Trial into the rasped cavity.

Note: *When fully inserted, the stem of the Guide should fit the prepared canal and need not necessarily abut the head of the Proximal Phalanx.*

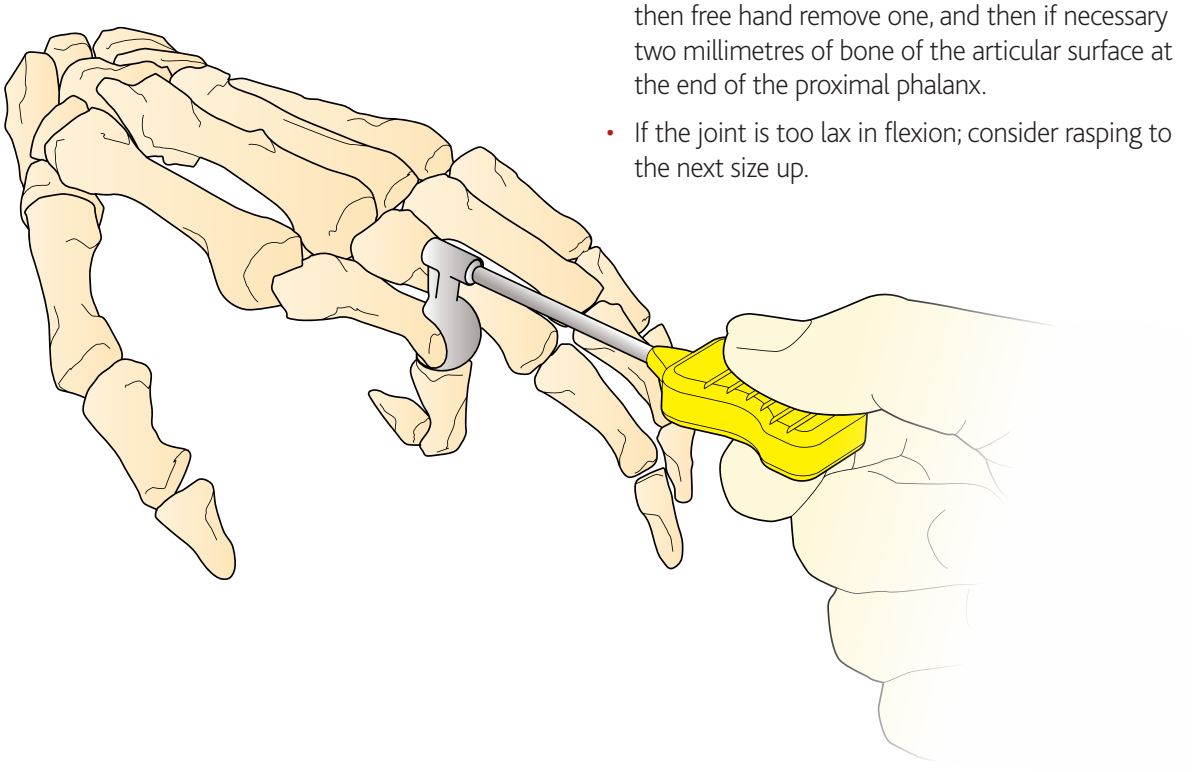
Joint Reduction

Try to reduce the joint so that the Balancing Trial is resting on the Middle Phalanx surface. If reduced successfully, gently try to move the finger through flexion and extension avoiding excessive force as this may damage the collateral ligaments. Assess the radio-ulner stability at this stage.



Problems when reducing the joint

- If the joint cannot be reduced; mill the Middle Phalanx further, making sure the ligament attachments are preserved.
- If the joint is too tight in flexion; mill the Middle Phalanx further, making sure the ligament attachments are preserved.
- If the joint does not extend to full extension; rasp the Proximal Phalanx further. If this is not successful, then free hand remove one, and then if necessary two millimetres of bone of the articular surface at the end of the proximal phalanx.
- If the joint is too lax in flexion; consider rasping to the next size up.

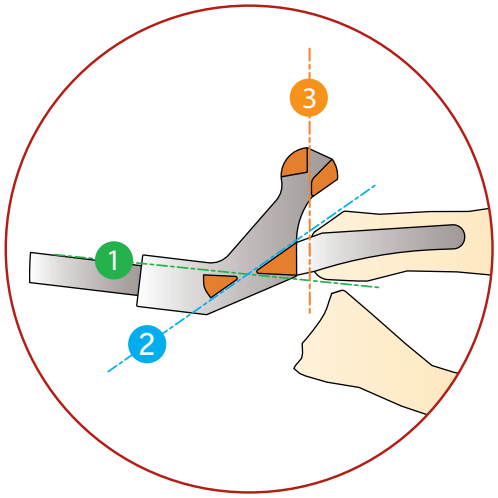


Step 8

Cutting the Proximal Phalanx

Select the appropriate sized 3 - Cut Guide and insert into the Proximal Phalanx.

Note: *When fully inserted, the stem of the Guide should fit the prepared canal and need not necessarily abut the head of the Proximal Phalanx.*

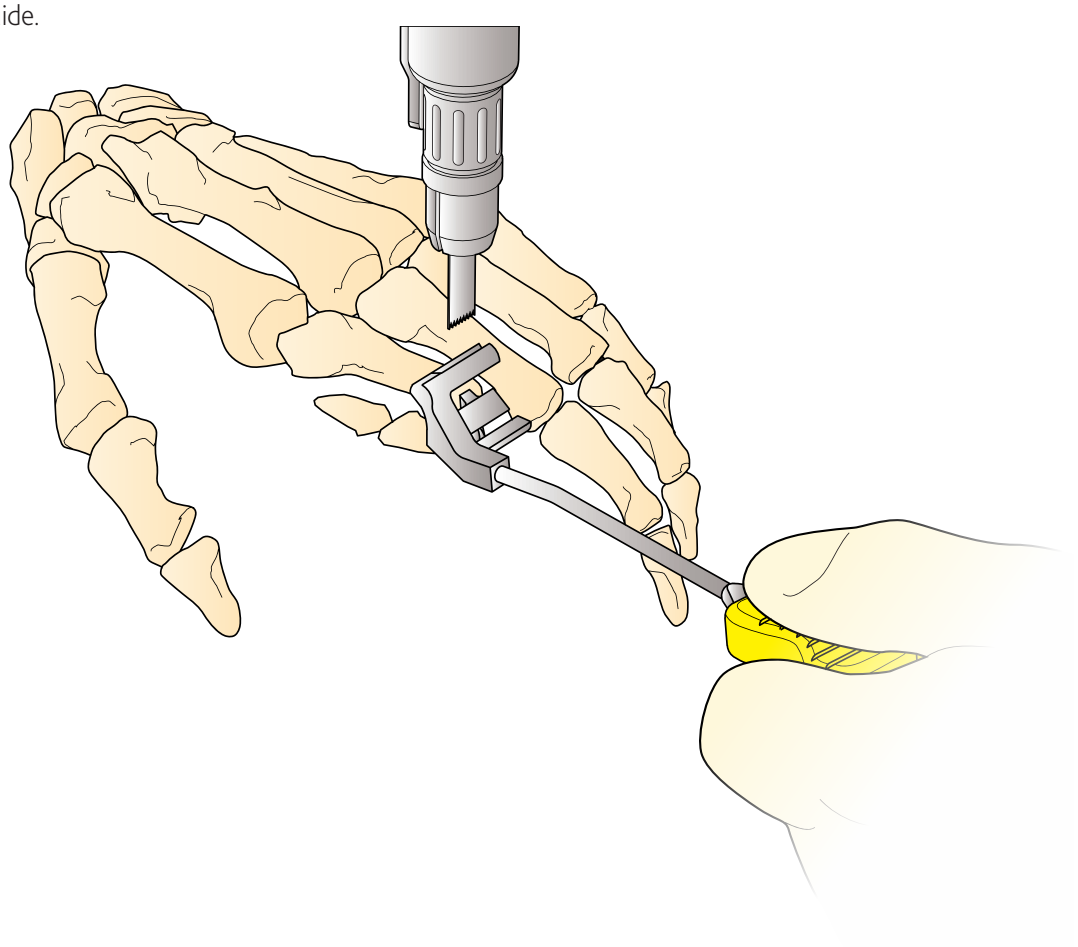


Using a small power saw with a 0.4 mm blade, make the two intersecting cuts (numbered 1 & 2, inset).

In each instance, first insert the blade between the two opposing guide pillars then gently bias the blade against the distal pillar to bring the blade into contact with both guiding surfaces. Whilst cutting, ensure that the blade remains in contact with both surfaces. Take care that the Guide is supported at all times to ensure that it remains seated.

Still supporting the Guide, make the distal cut (3, inset) either side of the Guide stem. Using the dorsal pillars, ensure the blade remains in contact with both guiding surfaces whilst cutting.

Once all three cuts are complete remove the 3 - Cut Guide.



Step 9

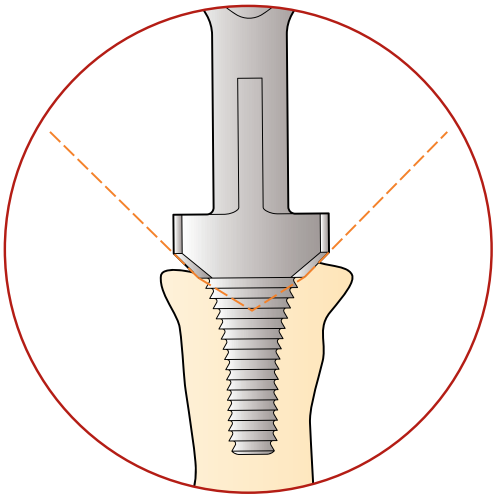
Rasp the Middle Phalanx

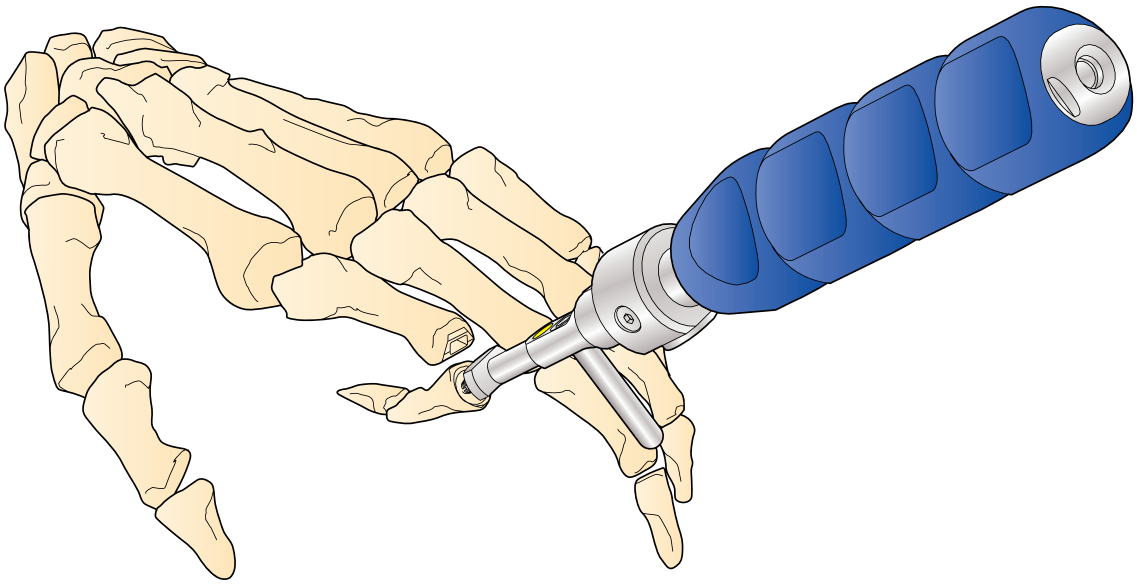
Select a Middle Rasp one size smaller than the estimated final size and assemble together with the Instrument Handle and Rasp Alignment Guide (if required). Work the Rasp into the cavity, backing-off regularly to clear debris, until the flange seats onto the milled surface. This stage can be facilitated by the use of a power burr.

Assess the fit and fill and, if necessary, progress to the next Middle Rasp size up.

The final Rasp size used (M7, M8, M9, M10, M11) should be recorded as this will indicate the Middle Component size to use.

Refer to the Sizing Chart for compatibility with the proximal component.





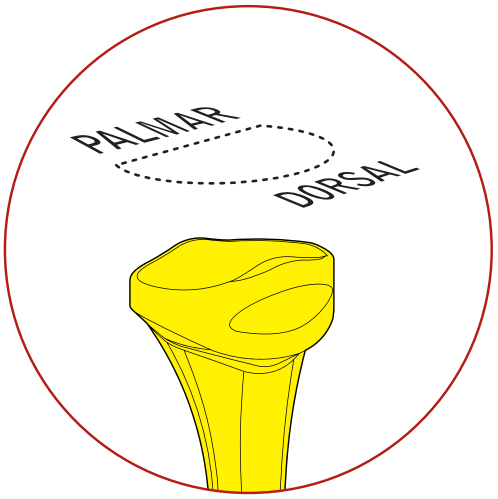
Step 10

The Middle Phalanx Trial

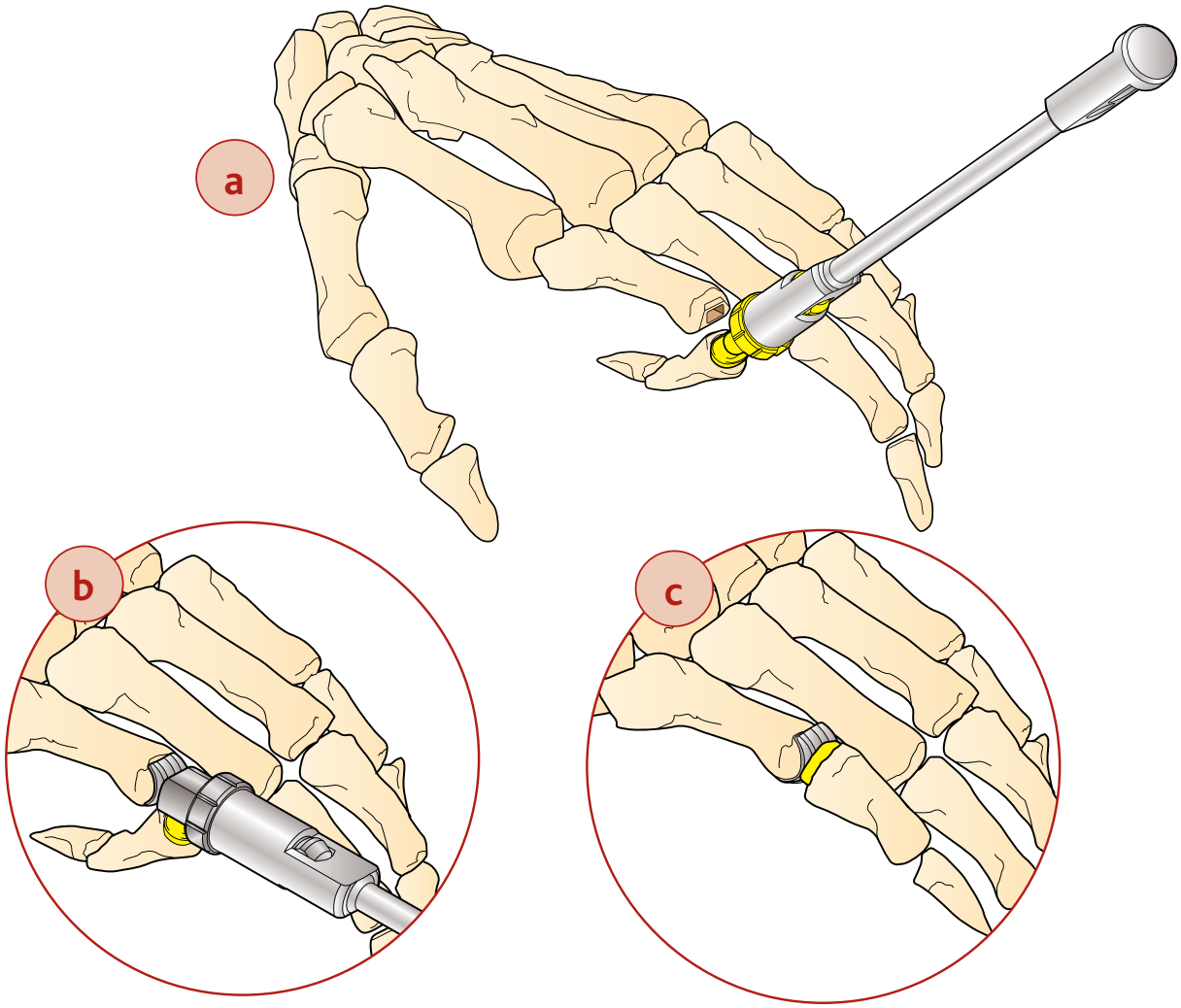
a) Select the required size Middle Implant Trial and insert it into the Middle Phalanx in flexion, noting the flat on the palmer side of the Trial as illustrated (detail right).

b) Insert the required size Proximal Implant Trial into the Proximal Phalanx, also in flexion. This will enable a full trial reduction. If necessary, use a power burr to break the edge of the cavity to allow the trial to be properly seated.

c) Gently move the finger to evaluate the full range of motion and stability. At this stage, the joint should be stable in extension with free movement between 0 and 90. It is of utmost importance that the joint is not "overstuffed" and tight. If this is the case, then the surgeon should return to step 7. If the collateral ligaments and volar plate are intact, it is unlikely that instability will be a problem.



Middle Implant Trial Orientation



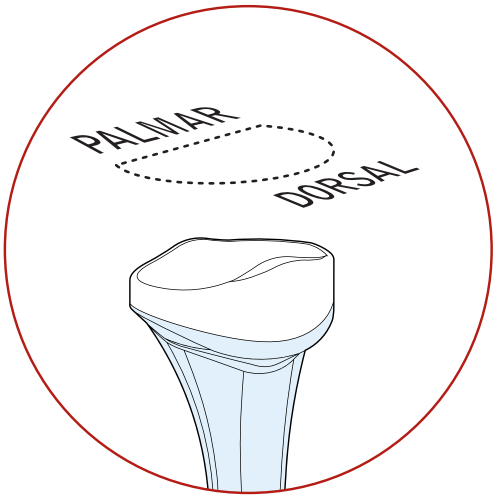
Step 11

Wash the prepared bone surfaces with saline lavage and dry thoroughly.

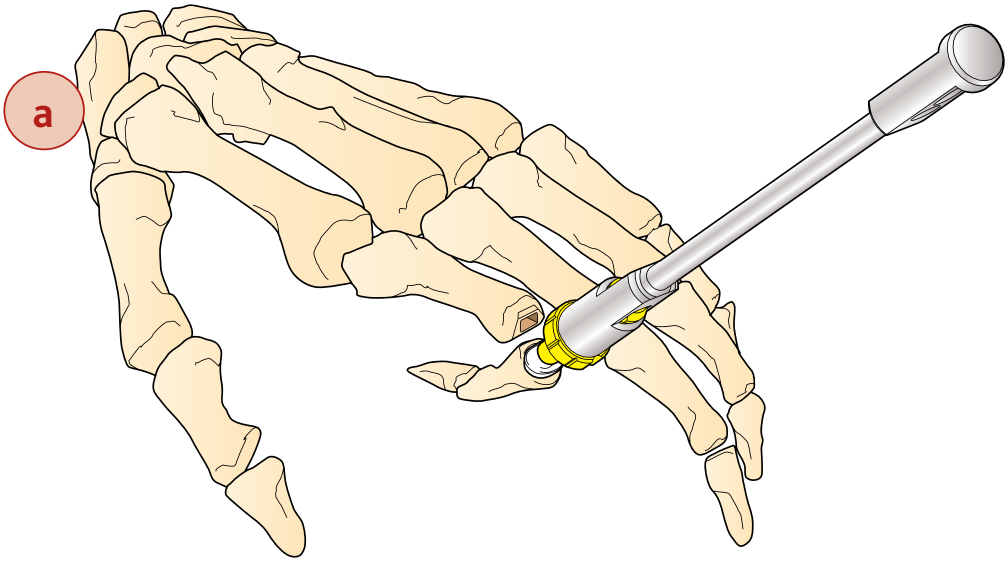
a) Insert and impact the Middle Component in flexion using the correct size plastic Middle Impactor observing the correct orientation (detail right).

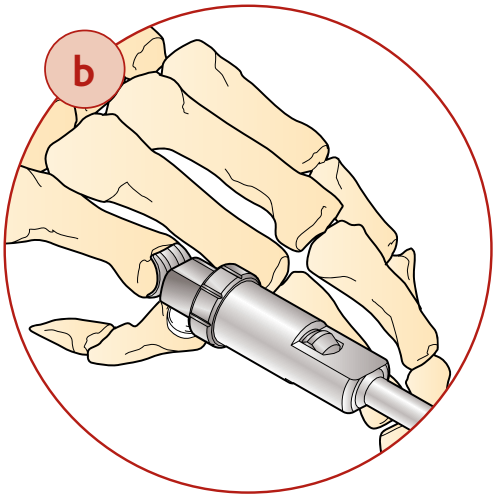
b) Insert and impact the Proximal Component in flexion using the plastic Proximal Impactor.

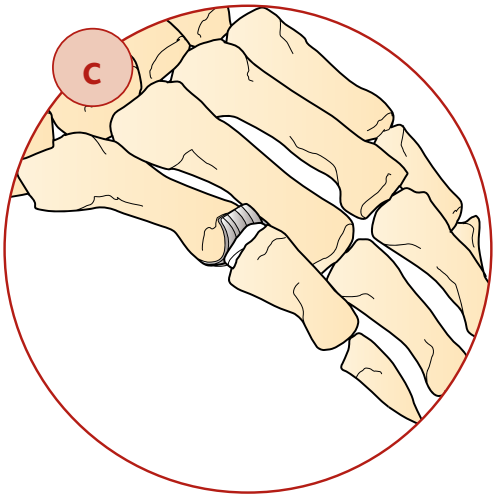
c) Gently move the finger to evaluate the full range of motion and stability.



Middle Implant Orientation





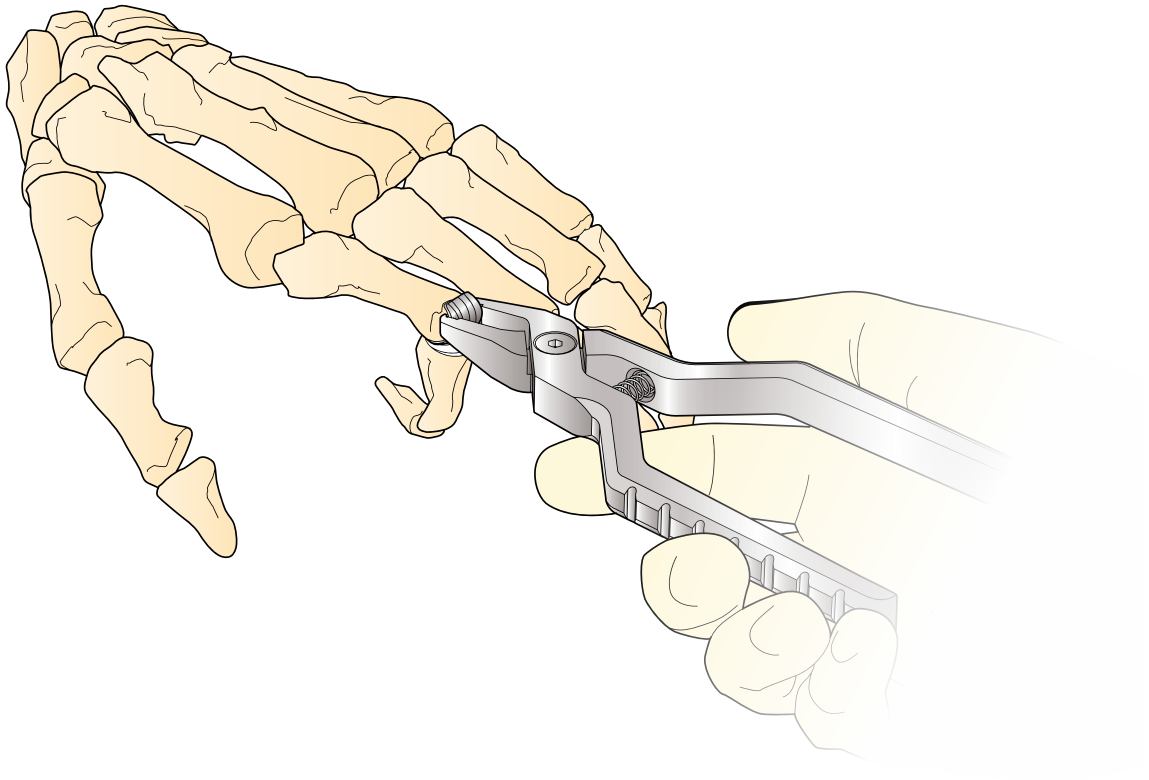


Step 12

Implant Salvage

Should it become necessary to remove a MatOrtho PIPR Implant, Extraction Pliers are provided. These should be carefully closed between the implant and bone, gripping and prising it away from the bone.

Note: *Implant components retrieved in this way should* ***NOT*** *be re-used.*

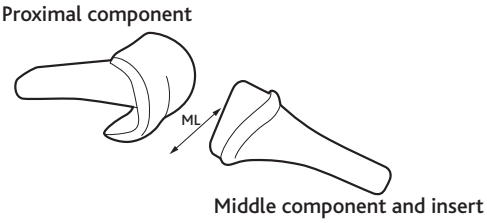


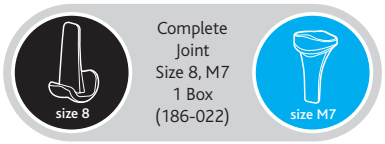
Step 13

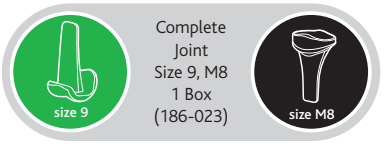
Close the Wound

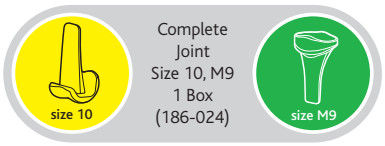
Repair the extensor apparatus re-anchoring it to the base of the proximal phalanx. The skin is then closed with interrupted suture.

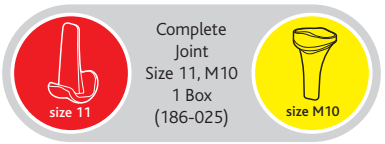
PIPR™ SIZES		
Proximal component	Middle component	Width (ML, mm)
P7	M7	7
P8	M8	8
P9	M9	9
P10	M10	10
P11	M11	11

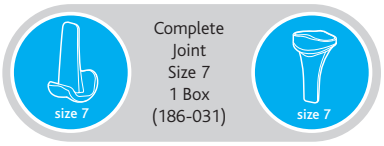


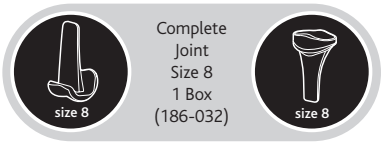


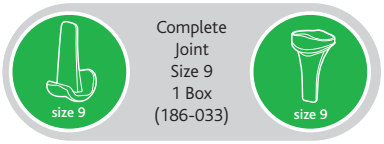


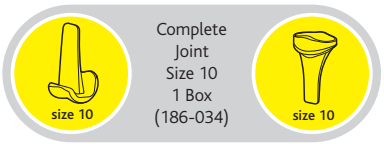


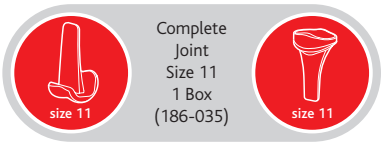












Operative details will dictate the exact nature of post-operative management.

Influencing Factors

- Pre-operative deformity
- Post operative stability of joint
- Collateral ligament repair
- Quality of extensor mechanism
- Intra-operative fracture
- Individual patient factors

Any, or a combination, of these factors may require an initial period of 3 weeks immobilisation followed by controlled/protected mobilisation dependant on individual circumstances.

In the absence of contra-indications **Early Mobilisation** is the treatment of choice.

Potential Problems

- Dorsal dislocation of joint
- Angulation of joint
- Rupture of extensor mechanism
- Stiffness

Therapy Objectives

- Stable joint
- Functional arc of movement - 20/60 degrees
- Pain free

Routine Management

Immediate Post-Op

Volar slab to finger tips.

Day 1

- Elevation
- Neurovascular observations
- Pain relief
- Antibiotics x 3

Early Mobilisation

If the joint is stable with good reattachment of the extensor mechanism and there are no patient specific problems.

Day 2-4

- Reduce dressing
- Wound inspection and application of light dressing to facilitate movement.
- Commence active mobilisation of PIP joint – three treatment options depending on whether single or multiple fingers, the amount of oedema and the patient's ability and comprehension.

Method 1

1. Hand/arm resting splint for all digits. Worn between exercises and at night (wrist neutral / 20 degrees extension; Metacarpal-Phalangeal (MCP) joints neutral; Proximal Interphalangeal (PIP) joints 30 degrees flexion)
2. Hand based MCP joint blocking splint used during exercise to direct active movement to PIP joint.

Method 2

1. Finger based dorsal blocking splint with integral MCP block; PIP joint positioned at 20-30 degrees.
2. Active PIP joint flexion 10-20 repetitions hourly.
3. Resting splint, as method 1, at night.

Method 3

This is the treatment of choice for those patients with pre-operative boutonniere deformities.

1. Dynamic extension splint during day.
2. Active flexion within splint.
3. Assisted extension from elastic recoil of splint.
4. Tension/20 degrees.

For all methods; functional use of the involved digit(s) should be discouraged.

Early Mobilisation continued...

3-4 weeks

Evaluate Progress.

Extensor Lag

1. Introduce extension assist splints and active extension to neutral.
2. Continue with flexion exercise and splints if necessary.

Poor Flexion

1. Introduce flexion assist splints.
2. Continue active flexion.
3. Position PIP joints in flexion at night.
4. Encourage active extension to neutral.

Monitor angulation of PIP joint and DIP (Distal Interphalangeal) joint and correct as necessary.

Discourage power grip and deforming ADLs.

6 Weeks

1. Evaluate Progress.
2. Discontinue protective splints.
3. Continue with extension or flexion assist splints, if appropriate and patient willing.
4. Resume functional use of hand but avoid heavy manual work.

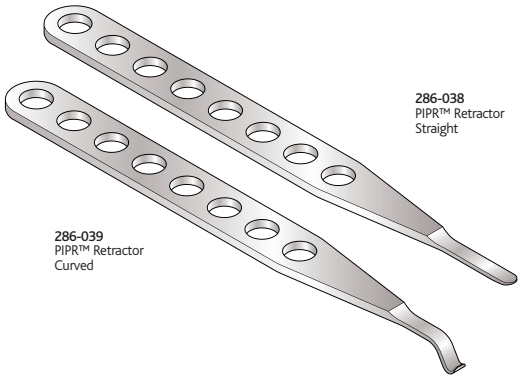
Delayed Mobilisation

Resting splint for 3 weeks (position of joint specific to each individual's requirements) followed by Method 1, 2 or 3 for the following 6 weeks.

Outcome

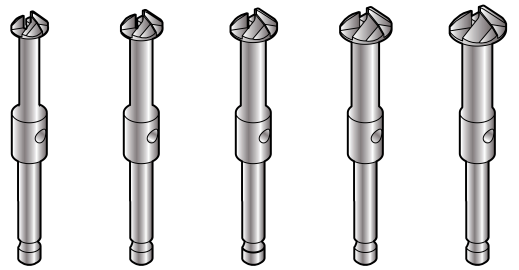
Related to pre-operative status, previous surgery and extent of injury:

- 20 degrees extension lag and 60 degrees flexion, no angulation, pain reduced from pre-operative status = satisfactory / good result.
- Full extension, 75 degrees flexion = excellent result.



286-038
PIPR™ Retractor
Straight

286-039
PIPR™ Retractor
Curved



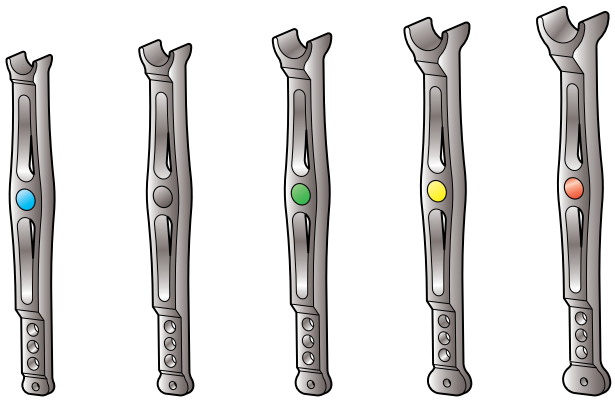
286-005
Conical Mill
Size 7

286-006
Conical Mill
Size 8

286-007
Conical Mill
Size 9

286-008
Conical Mill
Size 10

286-009
Conical Mill
Size 11



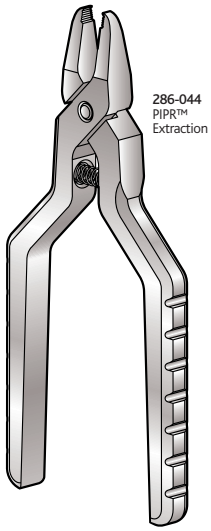
286-095
Sizing Template 7

286-096
Sizing Template 8

286-097
Sizing Template 9

286-098
Sizing Template 10

286-099
Sizing Template 11



286-044
PIPR™
Extraction Pliers

286-054
Middle Implant Trial Size 11

286-053
Middle Implant Trial Size 10

286-052
Middle Implant Trial Size 9

286-051
Middle Implant Trial Size 8

286-050
Middle Implant Trial Size 7

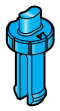
286-049
Proximal Implant Trial Size 11

286-048
Proximal Implant Trial Size 10

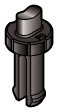
286-047
Proximal Implant Trial Size 9

286-046
Proximal Implant Trial Size 8

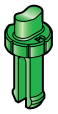
286-045
Proximal Implant Trial Size 7



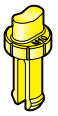
286-026
Middle Impactor
Size 7



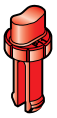
286-027
Middle Impactor
Size 8



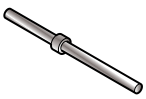
286-028
Middle Impactor
Size 9



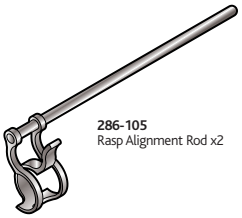
286-029
Middle Impactor
Size 10



286-030
Middle Impactor
Size 11

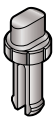


286-106
Alignment Rod 3mm

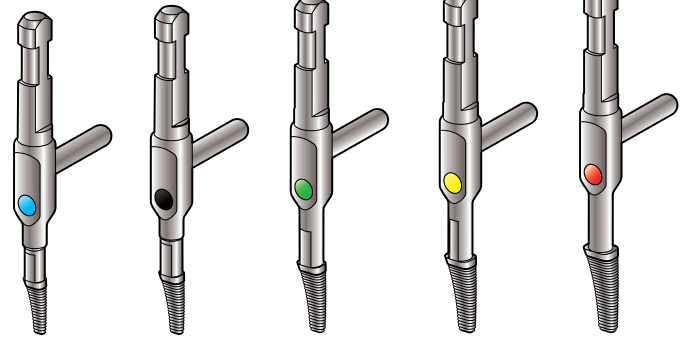


286-105
Rasp Alignment Rod x2

286-042
1.8mm Guide
Pin x5



286-036
Proximal Impactor



286-075
Proximal Rasp
Size 7

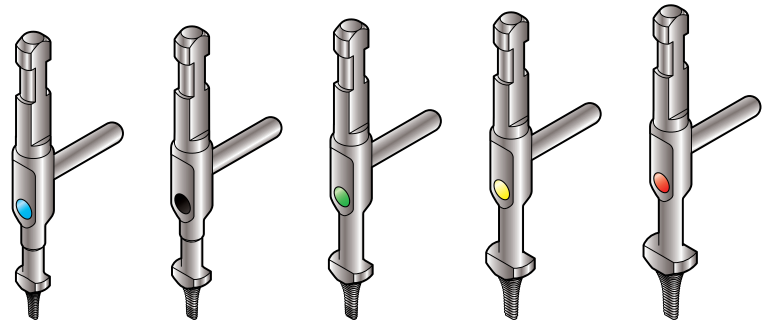
286-076
Proximal Rasp
Size 8

286-077
Proximal Rasp
Size 9

286-078
Proximal Rasp
Size 10

286-079
Proximal Rasp
Size 11

286-040
Impaction Handle x2



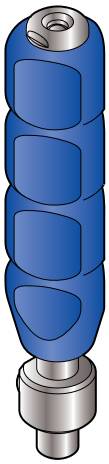
286-090
Middle Rasp
Size 7

286-091
Middle Rasp
Size 8

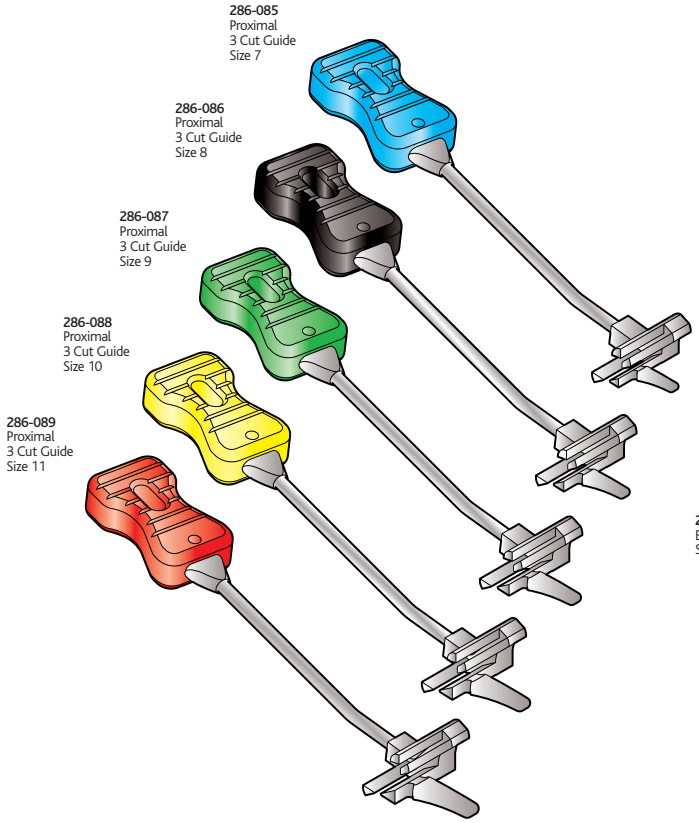
286-092
Middle Rasp
Size 9

286-093
Middle Rasp
Size 10

286-094
Middle Rasp
Size 11



261-108
Instrument Handle x2



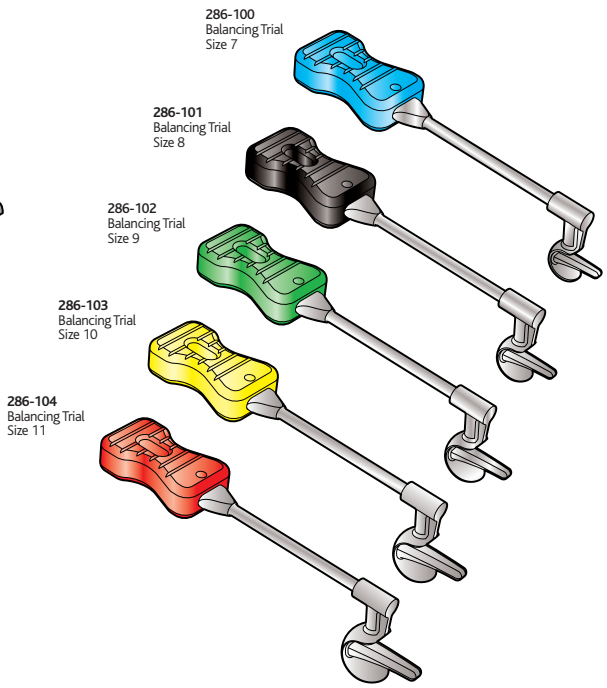
286-085
Proximal
3 Cut Guide
Size 7

286-086
Proximal
3 Cut Guide
Size 8

286-087
Proximal
3 Cut Guide
Size 9

286-088
Proximal
3 Cut Guide
Size 10

286-089
Proximal
3 Cut Guide
Size 11



286-100
Balancing Trial
Size 7

286-101
Balancing Trial
Size 8

286-102
Balancing Trial
Size 9

286-103
Balancing Trial
Size 10

286-104
Balancing Trial
Size 11

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Forever **Active**

MatOrtho Limited | 13 Mole Business Park | Randalls Road | Leatherhead | Surrey | KT22 7BA | United Kingdom.

T: +44 (0)1372 224200 | info@MatOrtho.com | For more information visit: www.MatOrtho.com

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