Inion CPS®

Inion’s biodegradable
Compact Plating System
for cranio-maxillofacial surgery
Clinical Requirements

The qualities that a fixation system must possess are:

- adequate strength & rigidity
- lack of adverse reactions
- lack of interference with bone healing
- lack of intracranial migration
- lack of visibility and palpability
- avoidance of an implant removal operation
- lack of imaging interference
- good handling properties such as plate malleability and good torsional strength of screws

extract from Biocompatibility and Fixation Properties of Absorbable Miniplates and Screws in Growing Calvarium, Hilkka Peltonieimi
Current Market Position

Titanium
Resorbables
Other
Titanium

- Universally accepted
- Familiar techniques
Problems with Metal Implants

- Cranial growth restriction Yaremchuk, 1994


- Implant palpability, temperature sensitivity & even visibility in thin skin areas Orringer et al 1998

Problems with Metal Implants

- Too stiff for optimal healing in some surgical applications - stress shielding may result in bone atrophy and porosis

- Accumulation of metals in tissues

- Adverse effects of metals can necessitate removal operation

Because of all these factors surgeons have been asking for a biodegradable product.
Statement regarding Plate removal

A (titanium) plate which is intended to assist the healing of bone becomes a non-functional implant once this role is complete. It may then be regarded as a foreign body.

While there is no clear evidence to date that a (titanium) plate causes any actual harm, our knowledge still remains incomplete. It is therefore not possible to state with certainty that an otherwise symptomless (titanium) plate left in situ in the long term is harmless.

The removal of a non-functioning (titanium) plate is desirable provided that the procedure to remove the plate does not cause any undue risk to the patient.

S.O.R.G., Volendam (NL)

November 1991

Strasbourg Osteosynthesis Research Group
The ideal implant would be made of a bioabsorbable material which:

• has appropriate initial strength to meet the biomechanical demands

• degrades in a predictable fashion remaining sufficiently strong until the bone has healed

• causes no deleterious tissue responses

• disappears completely

extract from Biocompatibility and Fixation Properties of Absorbable Miniplates and Screws in Growing Calvarium, Hilkka Peltonieimi
<table>
<thead>
<tr>
<th>Biodegradable Advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>• No second surgery required for implant removal</td>
</tr>
<tr>
<td>• No long term implant palpability or temperature sensitivity</td>
</tr>
<tr>
<td>• Non-metallic</td>
</tr>
<tr>
<td>• Predictable degradation to provide progressive bone loading &amp; no stress shielding</td>
</tr>
<tr>
<td>• Implants supplied sterile</td>
</tr>
<tr>
<td>✔ Reduced patient trauma &amp; cost</td>
</tr>
<tr>
<td>✔ Patient satisfaction</td>
</tr>
<tr>
<td>✔ No imaging interference</td>
</tr>
<tr>
<td>✔ Improved chance of bone healing</td>
</tr>
<tr>
<td>✔ Reduced cross infection potential</td>
</tr>
</tbody>
</table>
History of Biodegradables

The concept of using degradable materials which only serve a temporary function has been of interest for years.

Surgical suture is one of the earliest biodegradable implants in recorded history. Catgut suture was known in 150 AD in the time of Galen who built his reputation by treating wounded gladiators.

Several naturally occurring polymers have been used e.g. partially oxidised cellulose (Surgicel, Surgikos, USA).

Synthetic polymers are preferable to natural polymers where greater control over uniformity and mechanical properties are desired.
History of Biodegradables

Synthetic biodegradable polymers have been used in surgical applications for the past 30 years as suture materials:

- 1969 - Dexon (Davis & Geck) PGA suture
- 1972 - Vicryl (Ethicon) PGA/PLA 90:10 suture
- PDS (Ethicon)
- Maxon (Davis & Geck) PGA/TMC

In last two decades the use of biodegradable materials has expanded to include fixation applications:

- 1985 - Lactosorb wound closure clips
- 1987 - Ethipin/Orthosorb PDS pin
- 1989 - Biofix SR-PGA pin
- 1994 - Linvatec PLLA interference ACL screw
- 1995 - Biofix SR-PLLA screw
- 1996 - Lactosorb CMF plates & screws
- 1996 - Bionx Meniscus Arrow
Introducing...
The Inion Compact Plating System – Inion CPS®
Inion was founded in 1999 in Tampere, Finland by a team of recognized experts in biomaterials sciences.
Inion Optima™ Materials

• Inion have utilized the last 30 years experience with biodegradable polymers and selected materials with long, safe and effective clinical histories.

• Inion Optima™ materials are made by blending rigid polymer components and elastic polymer components.
Inion Polymers

The proportions of the constituents has a strong impact on the strength and malleability and absorption of the final product.

Inion tested numerous material recipes to establish the properties of the different copolymers.
Bending Tests
Plate Bending Stiffness in 4-point Bending

![Graph showing plate bending stiffness for different materials]

- LactoSorb 1.5
- Biosorb FX 1.5
- LactoSorb 2.0
- Biosorb FX 2.0
- Inion CPS 2.0
- Inion CPS 2.5
Plate Load Carrying Capacity in 3-point Bending
Tensile Test
Plate Tensile Load Carrying Capacity

Average yield load (N)

- Inion CPS 1.5 *
- Inion CPS 2.0
- Inion CPS 2.0 + 6 screws
- BioSorbFX 2.5
- BioSorbFX 1.5
- BioSorbFX 2.0
- BioSorbFX 2.0 + 6 screws
- BioSorbFX 2.4
- LactoSorb 1.5
- LactoSorb 2.0
Plate Tensile Strength Retention

In-vitro interval (weeks)
Mean max. value (N)
Inion CPS 2.0 Plate
Inion CPS 1.5 Baby Plate
Inion CPS 2.5 Plate

Plate Tensile Strength Retention
Pull-out Test
Screw Pull-out Tests

Mean maximum pull-out load (N)

- Inion CPS 1.5x4 mm screw
- Inion CPS 2.0x5 mm screw
- Inion CPS 2.5x6 mm screw
- BioSorbFX 1.5x6 mm screw
- BioSorbFX 2.0x6 mm screw
- BioSorbFX 2.4x6 mm screw
- LactoSorb 1.5x5 mm screw
Torsion and shear test
Screw Torsion Tests

- Inion CPS 1.5x6 mm screw
- Inion CPS 2.0x7 mm screw
- Inion CPS 2.5x6 mm screw
- BioSorbFX 1.5x6 mm screw
- BioSorbFX 2.4x6 mm screw
- LactoSorb 1.5x5 mm screw*
- LactoSorb 2.5x7 mm screw*

Mean maximum torque (Nmm)
Screw Shear Strength Tests

<table>
<thead>
<tr>
<th>Screw Type</th>
<th>Mean Maximum Load (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inion CPS 2.5x6 mm screw</td>
<td>150.0</td>
</tr>
<tr>
<td>Inion CPS BSSO 2.8x10 mm</td>
<td>200.0</td>
</tr>
<tr>
<td>Inion CPS BSSO 3.1x10 mm</td>
<td>320.0</td>
</tr>
</tbody>
</table>
The Unique Art of Making Biodegradable Polymers

By testing such a variety of polymers Inion has been able to establish a ‘library’ of materials from which to select ones of the appropriate strength, malleability and degradation to meet specific clinical requirements.
Tailored Inion Optima™ Material

- L Lactide: Provides strength to implants
- D Lactide: Disrupts crystallinity
- Glycolide: Degrades quickly
- TMC: Provides enhanced malleability
Inion Optima™
for optimal implant performance

• The polymers used for the screws will give optimal shear and torque.

• For the plates a different polymer combination is used to give optimal flexural and tensile strength.
Amorphous polymers

- the ideal for biodegradable implants

- Polymers with a high degree of crystallinity demonstrate a very long resorption time.

- In a semicrystalline structure, hydrolysis begins from the amorphous areas leaving the slowly degrading crystalline debris behind.

- Amorphous polymers are completely degraded.
Inion Optima™ materials are amorphous after injection molding due to their structure and will stay completely or substantially amorphous after this process.
The degradation profiles have been tailored to provide initial stability and then progressively load the bone to stimulate regeneration.
Degradation process

• **Stage 1 – Hydrolysis**
  - water attacks the chemical bonds converting the long polymer chains into shorter water-soluble fragments

• **Stage 2 – Metabolization**
  - metabolized into monomeric acids which enter the citric acid (Krebs) cycle

• **Stage 3 - Excretion**
  - excreted as water and carbon dioxide
Tailored Degradation

Remaining tensile strength and mass of Inion CPS Baby plate
In vitro in buffer solution at 37°C
Remaining Mass of CMF Plates

In vitro time (weeks)

Remaining mass (%)

Inion CPS 1,5/2.0

Inion CPS 2,5 / orthognathic

Inion CPS Baby
Scalloped design of the plates to optimize strength and malleability without screw hole deformation.

Maximum strength with minimum material per application:
- 1.5/2.0 mm plates are designed for easier bending
- 2.5 mm plates are designed for greater fixation support

Tight screw thread provides maximum thread engagement in cortex.
Inion CPS®

• The most comprehensive biodegradable implant system available – the only one comparable to titanium products in scope of applications

• Superior technological features – quick and easy to use with self tapping screws, “firing” of screws and simple plate adaptation
Inion CPS®

APPLICATIONS
Inion CPS® uses

Inion CPS® is suitable for CMF applications including:

- **Congenital deformities & growth disturbances**
  - Craniofacial
  - Orthognathic

- **Trauma**
  - Mandible
  - Zygoma
  - Mid Face – Le Fort I, II & III
  - Orbital rim
  - Naso Ethmoid
Implant Selection

1.5mm CPS BABY SYSTEM
For paediatric craniofacial procedures (equivalent use to titanium 1.0 - 1.2mm)
Strength retention is 6-9 weeks

1.5mm CPS SYSTEM
For low load-bearing cranial and midface fixation (equivalent use to titanium 1.0 - 1.2mm)
Strength retention is 9-14 weeks

2.0mm CPS SYSTEM
For medium load-bearing midface and orthognathic fixation (equivalent use to titanium 1.5 - 1.7mm)
Strength retention is 9-14 weeks

2.5mm CPS SYSTEM
For mandibular fixation (equivalent use to titanium 2.0 - 2.4mm)
Strength retention is 9-14 weeks
Inion CPS® - systems

• **Inion CPS® Baby 1.5 system** – malleable, fast resorbing
  ■ Pediatric craniofacial surgery
  ■ Cranium, periorbital & midface applications in children

• **Inion CPS® 1.5 system** – malleable, low profile
  ■ Adult non load bearing cranial, periorbital and antral wall applications
Inion CPS® - systems

• **Inion CPS® 2.0 system** – stronger, fairly low profile
  - Midface
  - As second plate in anterior mandibular trauma

• **Inion CPS® 2.5 system** – strong
  - Mandibular applications
  - 2.8mm screws for BSSO
Craniofacial Surgery
Inion CPS® Baby

Used for pediatric craniofacial surgery

- Malleable – easy to contour
- Rapid strength loss – to avoid growth restriction
- Fast resorption
Implant Selection – Inion CPS® Baby

Indications: Pediatric CMF
Material: LPLA/PGA/TMC
Strength Retention: 6-9 Weeks
Resorption Time: 2-3 years
Pilot Hole Diam.: 1.2 mm
Screw Pitch: 0.5 mm
Packaging Colour: Pink
Size Colour: Green
Plate Thickness: 1.0 mm
Plate/Screw Profile: 1.5 mm
Mesh Thickness: 0.5 mm
Mesh/Screw Profile: 1.5 mm

<table>
<thead>
<tr>
<th>SCREWS</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SCR-1220</td>
<td>1.5 x 4mm</td>
<td>5 pcs</td>
<td>Emergency (2.0 x 5mm)</td>
<td></td>
</tr>
<tr>
<td>SCR-1221</td>
<td>1.5 x 6mm</td>
<td>5 pcs</td>
<td>Emergency (2.0 x 7mm)</td>
<td></td>
</tr>
<tr>
<td>SCR-1210</td>
<td>2.0 x 5mm</td>
<td>5 pcs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCR-1211</td>
<td>2.0 x 7mm</td>
<td>5 pcs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MESHES</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PLT-1028</td>
<td>Mesh plate</td>
<td>7 x 7 holes</td>
<td>0.5 x 45 x 45mm</td>
<td></td>
</tr>
<tr>
<td>PLT-1029</td>
<td>Mesh plate</td>
<td>14 x 14 holes</td>
<td>0.5 x 90 x 90mm</td>
<td></td>
</tr>
</tbody>
</table>
Craniofacial Fixation

Most common implants used are:

- Inion CPS® Baby Mesh
- Inion CPS® Baby 20 hole plate
- Inion CPS® Baby 4 hole plate
- Inion CPS® Baby X plate
- Inion CPS® Baby 1.5 x 4mm screws

*If infant under 6 months old more Inion CPS® Baby 2.0 x 5mm screws may be required as the bone can still be very soft*
Orthognathic Surgery
Orthognathic Surgery

Courtesy of Professor Haers, RSCH
Orthognathic Surgery

courtesy of Professor Haers, RSCH
Le Fort I Osteotomy
Le Fort I Fixation

Courtesy of Professor Haers, RSCH
Le Fort I Fixation

Courtesy of Professor Haers, RSCH
Le Fort I Fixation

Courtesy of Ken Sneddon, QVH
Implant Selection – Inion CPS® 2.0

Indications: Low medium load bearing midface & orthognathic fixation

Material: LPLA/DLPLA/TMC

Strength Retention: 9-14 Weeks
Resorption Time: 2-4 years

Pilot Hole Diam.: 1.75 mm
Screw Pitch: 0.6 mm
Packaging Colour: Green
Size Colour: Blue
Plate Thickness: 1.3 mm
Plate/Screw Profile: 1.9 mm
Mesh Thickness: 0.6 mm
Mesh/Screw Profile: 1.6 mm

*Screws
- SCR-1224: 2.0 x 5mm, 5 pcs + Emergency (2.5 x 6mm)
- SCR-1225: 2.0 x 7mm, 5 pcs + Emergency (2.5 x 8mm)

*Meshes
- PLT-1032: Mesh plate, 7 x 7 holes, 0.6 x 45 x 45mm
- PLT-1033: Mesh plate, 14 x 14 holes, 0.6 x 90 x 90mm

*Strengthened material for orthognathics
Le Fort I Fixation

Most common implants used are:

- 2 x CPS 2.0 L Plate Left #PLT-1040
- 2 x CPS 2.0 L Plate Right #PLT-1039
- 4 x packs CPS 2.0 x 7mm screws #SCR-1225
Sagittal Split Osteotomy
Bicortical Screw Fixation of BSSO

3 bicortical screws are commonly used in an inverted L pattern
BSSO Fixation

Courtesy of Professor Haers, RSCH
Implant Selection – Inion CPS® 2.5

Indications: Mandibular fixation (with appropriate MMF)

Material: LPLA/DLPLA/TMC

Strength Retention: 9-14 Weeks

Resorption Time: 2-4 years

Pilot Hole Diam.: 2.25 mm for 2.5 mm screws
                      2.5 mm for 2.8 mm screws
                      2.8 mm for 3.1 mm screws

Screw Pitch: 0.7 mm

Packaging Colour: Green

Size Colour:
  2.5 mm Violet
  2.8 mm Black
  3.1 mm White

Plate Thickness: 1.3/1.7 mm min/max

Plate/Screw Profile: 2.1 mm

Mesh Thickness: 0.7 mm

Mesh/Screw Profile: 2.0 mm
BSSO Fixation

Most common implants used for plate fixation are:

• 2 x CPS 2.5 6 Hole Plates
  (mandibular advancement >3mm) #PLT-1025

or

• 2 x CPS 2.5 4 Hole Extended Plates
  (mandibular advancements <3mm or set back) #PLT-1024

• 2 x packs CPS 2.5 x 8mm screws
  (equivalent bone insertion to 7mm titanium screw) #SCR-1207

or if bicortical screw fixation preferred:

• 6 x 2.8mm x 12-18mm BSSO screws #SCR-1213-1216
Genioplasty
Genioplasty

Courtesy of Professor Haers, RSCH
Genioplasty
Genioplasty
Genioplasty Fixation

Most common implants used for chin **advancements** are:
- 2 x CPS 2.5 x 23mm Screws #SCR-1208 – cut to length

Most common implants used for chin **reductions** or down grafting (with graft) are:
- CPS 2.0 6 Hole Plate #PLT-1038 (cut in ½ to make 2 plates)
- CPS 2.0 x 7mm screws #SCR-1225
Post Operative Care

• It is important to note that Inion CPS® provides a semi-rigid fixation like titanium micro-plates.

• Therefore it is strongly advised that patients are put into guiding elastics for 4 to 6 weeks and have a soft, non chewing diet for 3 to 4 weeks.
Trauma
Zygomatic Fixation

Plate across zygomatico-frontal suture

Plate at infraorbital margin

Plate across zygomatic buttress
Zygomatic Fixation
Zygomatic Fixation

Courtesy of Professor Haers, RSCH
Zygomatic Fixation

Courtesy of Professor Haers, RSCH
Implant Selection – Inion CPS® 1.5

Indications
Low load bearing cranial & midface fixation

Material
LPLA/DLPLA/TMC

Strength Retention
9-14 Weeks

Resorption Time
2-3 years

Pilot Hole Diam.
1.2 mm

Screw Pitch
0.5 mm

Packaging Colour
Green

Size Colour
Green

Plate Thickness
1.0 mm

Plate/Screw Profile
1.5 mm

Mesh Thickness
0.5 mm

Mesh/Screw Profile
1.5 mm

---

PLATES

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLT-1005</td>
<td>4 hole plate</td>
<td>1.0 x 5.8 x 21mm</td>
</tr>
<tr>
<td>PLT-1006</td>
<td>6 hole plate</td>
<td>1.0 x 5.8 x 31mm</td>
</tr>
<tr>
<td>PLT-1007</td>
<td>20 hole plate (reinforced centre hole)</td>
<td>1.0 x 5.8 x 101mm</td>
</tr>
<tr>
<td>PLT-1008</td>
<td>C plate, 7 holes</td>
<td>1.0 x 5.8 x 33mm</td>
</tr>
<tr>
<td>PLT-1012</td>
<td>X-plate, 7 holes</td>
<td>1.0 x 16 x 28mm</td>
</tr>
<tr>
<td>PLT-1011</td>
<td>Burrhole plate, 1.0mm thick covers 14mm hole</td>
<td></td>
</tr>
<tr>
<td>PLT-1010</td>
<td>L-plate, left, 7 holes</td>
<td>1.0 x 5.8 x 28mm</td>
</tr>
<tr>
<td>PLT-1009</td>
<td>L-plate, right, 7 holes</td>
<td>1.0 x 5.8 x 28mm</td>
</tr>
</tbody>
</table>

---

SCREWS

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCR-1222</td>
<td>1.5 x 4mm, 5 pcs + 1 Emergency (2.0 x 5mm)</td>
<td></td>
</tr>
<tr>
<td>SCR-1223</td>
<td>1.5 x 6mm, 5 pcs + 1 Emergency (2.0 x 7mm)</td>
<td></td>
</tr>
</tbody>
</table>

---

MESHES

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLT-1030</td>
<td>Mesh plate, 7 x 7 holes</td>
<td>0.5 x 45 x 45mm</td>
</tr>
<tr>
<td>PLT-1031</td>
<td>Mesh plate, 14 x 14 holes</td>
<td>0.5 x 90 x 90mm</td>
</tr>
</tbody>
</table>
Zygomatic Fracture Fixation

Most common implants used are:

- **CPS 1.5 C plate #PLT-1008** for orbital rim
- **CPS 1.5 4 or 6 hole plate #PLT-1005 or PLT-1006** for zygomatic arch & Z-F suture
- **CPS 1.5 x 6mm screws #SCR-1223**
- **CPS 2.0 x L plate #PLT-1039/#PLT-1040**
- **CPS 2.0 x 7mm screws #SCR-1225 or**
- **CPS 1.5 L plate #PLT-1009/ PLT-1010**
- **CPS 1.5 x 6mm screws #SCR-1223** for zygomatic/maxillary buttress
Orbital Floor Repair

Most common implants used are:

- Inion CPS® 1.5 Mesh #PLT-1030
- Inion CPS® 1.5 x 4mm screws #SCR-1222

Since the mesh is resorbable it cannot be used as a substitute for bone grafting
Mandibular Fractures

condylar

coronoid

angle

body

parasymphysis

dentoalveolar

Symphysis (midline)
Frequency of Mandibular Fractures

- Coronoid fractures 1%
- Condylar neck fractures 20%
- Angle fractures 20%
- Body fractures 20%
- Symphyseal fractures 11%
- Parasymphysseal fractures 13%
- Subcondylar fractures 35%
Mandibular Fracture Fixation

Courtesy of Professor Haers, RSCH
Mandibular Fracture Fixation

Most common implants used are:

- **Inion CPS® 2.5 4 Hole Extended Plate #PLT-1024**
- **Inion CPS® 2.5 x 8mm screws #SCR-1207**

For the second plate in symphyseal region:

- **Inion CPS® 2.0mm 6 Hole Plate #PLT-1038**
- **Inion CPS® 2.0 x 7mm Screws #SCR-1225**

*can be used if there is insufficient room for a second CPS 2.5 plate*
Plate Activation

Inion CPS® Plates and Meshes are ‘activated’ by heating in the Thermo water bath.

It takes 1-2 minutes for them to be most malleable.

Plate and Mesh adaptation is carried out after activation.
Plate Adaptation

The plates are most malleable for 15 seconds after removal from the water bath and can easily be adapted by hand.

As the plate cools it becomes more rigid. It can still be bent once cooled but bending pliers may be needed.

The plate can be re-heated in the water bath at any time.

Briefly dipping part or all of the plate into the water softens the plate for minor adjustments to be made. If fully immersed for several seconds the plate softens and loses all existing contours for total re-adaptation.
Plate Adaptation

Plates can be cut using surgical scissors.

Plates are easiest to cut when soft on removal from the water bath.

If necessary long screws can be cut to length with scissors or small wire cutters.
Screw Preparation

Inion CPS® Screws are mounted in a convenient screw-ring.

The universal screwdriver is used for all Inion CPS® screw sizes.

Inion CPS® Screws have a simple push-fit pick-up design which gives a very secure hold.
There are 4 methods of screw insertion:

1. Drilling + manual tapping + screwing

2. Drilling with self-tapping drill bit + screwing (only @ slow speed)

3. Drilling + self-tapping screw (thin bone only)

4. Drilling + shooting with Inion Tacker™
Screw Insertion Methods

1. Manual Tap

**MANUAL TAP METHOD**

Create a screw hole to the required depth using the appropriate drill bit attached to a slow speed drill (maximum 2,000 rpm) and irrigation.

Manually tap the hole in the bone.

Insert screw with screwdriver. Do not overtighten.
2. Self Tapping Drill

**SELF-TAPPING DRILL METHOD**

Use the self-tapping drill, with irrigation, at a MAXIMUM SPEED of 100 rpm. Stop drilling IMMEDIATELY BEFORE the drill stop contacts the plate or bone and reverse out carefully so as not to strip the prepared threads.

Insert screw with screwdriver. Do not overtighten.
3. Self-tapping screw

Inion CPS® screws are durable enough for them to be used as self-tapping screws for thin cortex (less than 2 mm)

Drill a hole

Insert screw with screwdriver. Do NOT overtighten.
Screw Insertion Methods

4. **Tacker**  
The *fastest* solution: Inion Tacker™

Insert a screw-ring into the loader

Cock the Inion Tacker™ by turning the handle clock-wise
4. **Tacker**  The *fastest* solution: Inion Tacker™

Inert the screw into the Tacker™ by pushing the loading button

The screw is held at the tip of the piston
Screw Insertion Methods

4. Tacker

Press the cannula firmly over the screw hole and fire the screw in.
Inion Tacker™

Courtesy of Professor Haers, RSCH
Inion Tacker™

The Tacker is ideal for the maxilla, especially for Le Fort I osteotomies as it speeds up the application of the 16+ screws.

Courtesy of Professor Haers, RSCH
Tacker tips

Ensure that the screw is positioned centrally in the screw hole. If the screw is fired into the side of the plate, the screw or plate can break.

If the plate is not accurately adapted to the bone, the screw will not pull it into place by using the Tacker.

The Tacker should be held at 90° to the plate for screw insertion and held firmly onto the plate before firing.

If the screw is not fully inserted just fire again. Do NOT try to screw it in.

Courtesy of Professor Haers, RSCH
Tacker tips

For VERY thin bone (transparent) do not use the Tacker as it can fracture the bone. Use the screws with the manual tap or as self tapping.

For very dense bone (orbital margins and mandible) the Tacker may not drive the screw in fully and the screw heads can distort. Use the manual tap for these areas.
Osteosynthesis Techniques

The same osteosynthesis techniques, as described for metal plates and screws, should be used for biodegradables.

For optimum success, it is essential that these are meticulously adhered to.

Because of the fine thread pitch of the Inion CPS® screws it is essential that particular attention be paid to careful drilling and screw insertion.
Successful osteosynthesis depends on the quality of the holes drilled into the bone to take the screws. Careful and accurate drilling is therefore a top priority. Though the hole need not be exactly perpendicular to the plate surface, it must be strictly monoaxial.

After drilling 3 – 4mm deep into healthy bone, a decrease in resistance will be felt, indicating that the cancellous bone layer has been reached. Stop drilling.
Drilling

Any change in the drilling angle during the drilling procedure will invariably result in a conical hole and thus reduce the number of threads finding adequate purchase in the bone.

During the entire drilling procedure, provide continuous irrigation to avoid thermal necrosis.
When tightening the screw in the bone, care must be taken to not use too much force to avoid destruction of the bone threads.

Each plate must be anchored by at least 2 screws on either side of the fracture site.
Screw Anchorage

Should the screw anchorage in the outer cortex be suspect, the drilling should be continued though the inner cortex and a longer screw inserted for bicortical fixation.

Another alternative would be to use a “spaced” plate and drill new holes as required.
Plate Adaptation

It is crucial that the plate be congruent to the bone surface before anchoring it by means of the screws.
Plate Adaptation

Once one or several screws have been inserted, no attempt should be made to improve on the shape of the plate. Such an attempt would result in the loosening of the screws already fastened.
Plate Positioning

Mandibular fracture fixation is achieved using plates by resisting the forces produced by chewing. The ideal position for placing these plates is indicated above.

For mandibular body fracture fixation, one plate is sufficient to provide firm support and to offset the tensile forces.

In front of the mental foramena (premolars), 2 plates are necessary to resist the torsional forces.
Inion CPS®

PROCEDURES
Bimaxillary Osteotomy

Keith Altman
Consultant Maxillofacial Surgeon
University of Brighton & Sussex Hospitals, UK
Bimaxillary Osteotomy
courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy

courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy

courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy
courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy
courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy

courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy
courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy

courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy
courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy
courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy
courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy
courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy
courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy

courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy
courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy
courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy
courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Bimaxillary Osteotomy

courtesy of Keith Altman, Maxillofacial Surgeon, University of Brighton & Sussex Hospitals
Mandibular Angle Fracture

Ken Sneddon
Consultant Maxillofacial Surgeon
Queen Victoria Hospital, East Grinstead
UK
Mandibular Fracture

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Mandibular Fracture
courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Mandibular Fracture

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Mandibular Fracture

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Mandibular Fracture

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Mandibular Fracture

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Mandibular Fracture

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Mandibular Fracture

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Mandibular Fracture

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Mandibular Fracture
courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Mandibular Symphyseal Fracture

Ken Sneddon
Consultant Maxillofacial Surgeon
Queen Victoria Hospital, East Grinstead
UK
Mandibular Fracture
courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK

6 hole 2.0 mm plate
4 hole 2.5mm spaced plate
Mandibular Fracture

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Mandibular Fracture
courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Mandibular Fracture

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Mandibular Fracture
courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Mandibular Fracture

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Zygomatic Fracture

Ken Sneddon
Consultant Maxillofacial Surgeon
Queen Victoria Hospital, East Grinstead
UK
Zygomatic Fracture

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK.
Zygomatic Fracture
courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Zygomatic Fracture
courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Zygomatic Fracture
courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Zygomatic Fracture

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Zygomatic Fracture

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Zygomatic Fracture
courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Zygomatic Fracture
courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Orbital Floor Repair

Ken Sneddon
Consultant Maxillofacial Surgeon
Queen Victoria Hospital, East Grinstead
UK
Orbital Floor Repair
courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Orbital Floor Repair
courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Orbital Floor Repair

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Orbital Floor Repair
courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Orbital Floor Repair

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Orbital Floor Repair

courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Orbital Floor Repair
courtesy of Ken Sneddon, Consultant Maxillofacial Surgeon, Queen Victoria Hospital, East Grinstead, UK
Clinical Requirements

The qualities that a fixation system must possess are:

- adequate strength & rigidity
- low risk of adverse reactions
- lack of interference with bone healing
- lack of intracranial migration
- low risk of visibility and long term palpability
- avoidance of an implant removal operation
- lack of imaging interference
- good handling properties

Inion CPS® delivers:

- ✔
- ✔
- ✔
- ✔
- ✔
- ✔
- ✔
- ✔