What type of mini-implants?

Osseointegrated
Non-osseointegrated

Non-osseointegrated

- Require a tight fit to be effective
- Stability depends on the quality and quantity of cortical and trabecular bone.

AbsoAnchor

AbsoAnchor

AbsorAnchor

AbsorAnchor
AbsoAnchor vs. Dual-top

- 102 AbsoAnchor vs. 98 Dual-top on mini-pigs.
- Immediately loaded with tension coil 100, 300, 500 cN
- 3 different distance from bone rim to neck of implants: 1, 2, 3mm

Absor-anchor vs. Dual-top

<table>
<thead>
<tr>
<th></th>
<th>Absoranchor</th>
<th>Dual top</th>
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<tbody>
<tr>
<td>Fracture during insertion</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Fracture during removal torque test</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Show implant bending and peri-implant bone loss during tension force test</td>
<td>4</td>
<td>1</td>
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</tbody>
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Absor-anchor vs. Dual-top

- Removal torque: Dual top > absoranchor
- Implant failure is related to the tipping moment at the bone rim
- As long as the tipping moment is under 900 cN-mm, mini-implants can be loaded immediately
Osseointegrated

- **C-Implant (Korea):**
  - Diameter: 1.8mm,
  - Length: 8.5mm, 9.5mm, 10.5mm
  - Surface: sandblasted, large-grit, and acid-etched.
  - The head measures 2.5mm in diameter and 5.35mm, 6.35mm, or 7.35mm in height. It contains a 0.8mm-diameter hole located 1mm, 2mm, or 3mm from the top of the screw.

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Surgical Guide

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Implant Angle

- Recommended angles of the implant to the long axes of the teeth have ranged from 10-20° in the mandible and from 30-40° in the maxilla.
How much **force**?

For placement of implant?
For withstand orthodontic force?

**Surgical Guide**

- Y&B Products, Thailand
  
  – Suzuki EY, 2005

- A custom manual screwdriver fits exactly inside the stainless steel tube.

**Implant placement torque (IPT)**

- The IPT in the mandible was significantly higher in the failure group than in the success group. Therefore, a large IPT should not be used always.
- The recommended IPT is within the range from 5-10 Ncm
  
Pull-out strength


Pull out strength

- Fmax: anterior mandibular region (134.5 ± 24N, mean ± SE) < posterior mandibular region (388.3 ± 23.1N).
- Normal orthodontic force: 0.3-4 N
- Greater pull-out strength in the posterior regions of the jaws

Screw location vs. cortical bone thickness

- Regression analyses suggested a weak (r = 0.39, P = .02) but significant correlation between Fmax and cortical bone thickness.
- Cortical bone thickness
  - Anterior region: 1.3mm
  - Posterior region: 2-2.4mm

Cortical bone thickness

A recent study suggests that screws tested with the axial pull-out method have 34% higher pull-out force than the same screws tested with a tangential pull-out method.
Retraction force

- Irreversible deformation of TPA occurred at 408.5 cN.
- Force of 300-400 cN causes anchorage loss.
- Instability of the implant proved not to be the cause of the loss of anchorage. The mesial movement of the anchor teeth was rather caused by a slight deformation of the long arms of the transpalatal bars between the implant and the anchor teeth.

Application

- Bi-maxillary protrusion
  - Kyung HM, 2004
- Micro-implant: 12mm long, 1.3 mm in diameter, from Dentos, Inc., Korea

- Total tx time: 20 months
- Gummy smile, deep bite 7.2mm
Intrusion of upper incisors in deep bite case

- 1.2mm in diameter, 6 mm long
- Orthoanchor K1 system, Dentsply Sankin corp., Japan

Mini-implant: 3mm above the root apex, between the roots

Initial implant placement >> 6 months healing period >> abutment placement >> 2 months healing >> activate intrusion with 20 g for 15 months with ligature wire or elastic thread

Initial implant placement >> 6 months

No incisor root resorption

Unilateral distal molar movement with an implant-supported Distal Jet Appliance

- Upper left 2nd premolar was impacted due to mesial drifting of 1st molar
- The joint between the implant and the appliance was secured with composite material.
- 8 mm of space was created within 4 months
- Karaman AI. 2002

Intrusion of molars

- Yao C.C., Angle orthodontist, 2004
- Yao C.C., Angle orthodontist, 2004
Mini-implant 2mm in diameter, 15 mm long (Leibinger, Freiburg, Germany)

- 3 mm of intrusion of 1st molar was accomplished.

En Masse retraction of whole arch in non-extraction case
- If the amount of distal movement of upper molars is less than 3mm, place the mini-implant on the buccal side between 5 and 6.
- If the amount of distal movement of upper molars is more than 3 mm, place the mini-implant on the palatal side between 6 and 7.


En Masse retraction of whole arch in non-extraction case
- In the mandibular arch, place the mini-implant between 6 and 7, distobucal side of 7 or retromolar area.


Complication
- The drill will stop or the patient will report pain if a root is contacted, and that the direction of drilling can then be adjusted until a satisfactory implant site is found.
  -- Kyung HM, 2003; Somchai M, 2004
- The roots can be expected to recuperate completely even when severely damaged.
  -- Kyung HM, 2003

• Taking micro-CT from 5 human maxillary bone specimens
• Horizontally sectioned images of the interalveolar septum area 2,4,6,8,10 and 12 mm deep from the alveolar crest
• Results: the safest location between upper 5 and 6 for mini-implant is 6-8 mm apical to alveolar crest from the palatal side.
A sudden increase in resistance after penetration of the cortical bone indicates root contact, which means the angle of insertion must be changed to avoid damage.

Because the retraction force is applied buccally, the molars will roll lingually and distally. Buccal crown torque and buccally flaring bend should be used to prevent this from happening.


Success rate: diameter

- 1 year success rate: 1mm in diameter (0%, all failed)< 1.5 (83.9%) or 2.3mm (85%) in diameter
  – Miyawaki S. et al. AJODO 2003;124:373-8

Success rate: Location of implants

- Miyawaki 2003: max posterior = md posterior
- Cheng 2004: max posterior > md posterior
- Motoyoshi 2006: max posterior = md posterior

Success rate: brands of implants

- 70%: 8mm long, 1.6-2mm in diameter, Jeil Medical Corp. (South Korea)
- 74.2%: 6mm-long/1.6mm-diameter
  – early-loaded (81.3%) = the delayed-loaded (83.3%) OMI's.
  – The loaded-OMI success rate overall (82.4%) > the control-OMI (non-loaded) success rate (65.6%).
  – OMI's placed in the posterior mandible had the lowest success rate (66%) and as a trend, the more posteriorly placed in either arch, the lower the success rate. However, no statistically significant differences in success rates were found among these groups.
  – Garfinkle, JS. et al. IADR presentation

Success rate: brands of implants

- 50%: orthoanchor K1 mini-implants, delayed loaded for 7-15 weeks,
  – K1 fracture during implantation: 9.1%
  – K1 fracture during mastication: 2.3%
  – K1 loosening before and after force application were 22.7% and 16% respectively;
  – the failure rate on maxilla was higher than that on mandible (38.6% V.S. 11.4%),
  – the failure rate of implanted position on mucosa higher than that on attached gingival (47.7% V.S. 2.3%).
  – Cheng HC. et al. IADR presentation
Success rate: brands of implants

• 85.5%: ISA orthodontic implant, 1.6mm in diameter, 8mm long

Success rate: Non-related factors

• Miyawaki 2003: screw length, kind of placement surgery (flap vs. no flap), immediate loading, age, gender, crowding of teeth, A-P jaw relationship, controlled periodontitis, TMD
• Motoyoshi 2006: age, gender

Success rate: self-drilling vs. self-tapping

• self-drilling group: (93%)
• self-tapping group (86%).
• Higher peak insertion torque and peak removal torque values were seen in the self-drilling group in both the maxilla and the mandible.
• A tendency to fracture was found in self-drilling group.
• The percentage of bone-to-implant contact values was greater in the self-drilling group.