Mini implants are becoming more frequently used as a treatment option for improving retention of dentures. When traditional implant treatment is not within the patient’s financial means, the use of mini implants to improve denture retention can provide improvement in the patient’s quality of life (QOL).

Patients are living longer, and as masticatory ability is tied to nutrition, patients with poorly retained dentures may suffer from nutritional deficiencies due to their inability to masticate food. As nutrition decreases, patients’ general health is affected and their QOL suffers. This can be corrected with improved denture retention, allowing patients to masticate more efficiently and improve their diet.

The immediate-load nature of the mini implants gives patients an immediate satisfaction without delays in treatment to accommodate conventional healing, permitting full osseointegration. Because mini implants are one-piece fixtures and are immediately loaded, it is important to avoid lateral loads on the fixtures that may lead to failure of the implant to integrate and loss of the fixture.

The mini implants available on the market (Table 1) have all utilized an “O” ring, which, due to the height of the head needed, may create restorative issues or allow lateral loads to be placed on the head during insertion or removal of the prosthesis. Sterngold introduced a mini implant using a smaller version of their ERA attachment, and distribution transferred to Zimmer Dental in 2010. As the supercrestal portion of this implant is lower than the “O” versions of the mini implant, divergence of the fixtures is less of an issue (Figure 1). Additionally, since less of the fixture is supercrestal, less lateral load can be placed on the fixtures during function or insertion/removal of the prosthesis. An added benefit is with a lower attachment head, less acrylic needs to be removed from the denture to accommodate the attachment’s male than when an “O” ring is used.

The ERA Mini™ implant is available in both a 2.2- and a 3.25-mm version with several lengths provided (Figure 2). The 3.25 version also allows for angle correction, should...
that be necessary, with a lutable female correction attachment available in 0-, 5-, 11-, and 17-degree angulation (Figure 3).

**Methods and techniques**

A key to simplification of placement of mini implants, as with traditional implants, is development of a guide to position the implants in the correct buccal-lingual orientation. Improper placement in the buccal-lingual plane can create restorative issues because the attachment may protrude out of the denture flange. A surgical stent using a duplicate of the patient's denture allows implant placement within the confines of the denture and orientation of the mini implant head so that it lies under the teeth.

To fabricate the surgical stent, an alginate such as Kromopan® (Kromopan®) is mixed and placed into one half of a Lang™ Denture Duplicator (Lang™ Dental), and the patient's denture is placed tooth side down into the alginate and allowed to set. A second batch of alginate is mixed and placed into the tissue side of the denture sitting in the lower half of the Lang™ Denture Duplicator. The upper half is filled with alginate, and the duplicator is closed, allowing the material to set. After setting, the

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**Table 1: Mini implants available in the US (diameters of <3.25 mm)**

<table>
<thead>
<tr>
<th>Company</th>
<th>Diameters available</th>
<th>Lengths available</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M/ESPE Imtec</td>
<td>1.8, 2.1, 2.4, 2.9 mm</td>
<td>10, 13, 15, 18 mm</td>
</tr>
<tr>
<td>AB Dental USA</td>
<td>2, 2.4, 3, 3.2 mm</td>
<td>10, 11.5, 13, 16 mm</td>
</tr>
<tr>
<td>American Dental Implant®</td>
<td>2.4 mm</td>
<td>10, 11.5, 13, 16 mm</td>
</tr>
<tr>
<td>Basic Dental Implant</td>
<td>3.0 mm</td>
<td>11, 13, 15 mm</td>
</tr>
<tr>
<td>Bicon®</td>
<td>2.5 mm</td>
<td>8, 12 mm</td>
</tr>
<tr>
<td>Dentatus</td>
<td>1.8, 2.2, 2.4 mm</td>
<td>7, 10, 14 mm</td>
</tr>
<tr>
<td>Dio® Dental Implants</td>
<td>2, 2.5, 3 mm</td>
<td>10, 12, 14 mm</td>
</tr>
<tr>
<td>Euro Dental Implant</td>
<td>2.7 mm</td>
<td>9, 11, 13, 15 mm</td>
</tr>
<tr>
<td>Hi-Tec Implants</td>
<td>2.5 mm</td>
<td>11.5, 13 mm</td>
</tr>
<tr>
<td>Hiossen</td>
<td>2.5, 3.0 mm</td>
<td>10, 13, 15 mm</td>
</tr>
<tr>
<td>Implant Direct™</td>
<td>3.0 mm</td>
<td>8, 10, 13 mm</td>
</tr>
<tr>
<td>Implantium</td>
<td>2, 2.5, 3 mm</td>
<td>8, 10, 12 mm</td>
</tr>
<tr>
<td>Intra-Lock®</td>
<td>2.0, 3.0 mm</td>
<td>10, 11, 13, 15, 18 mm</td>
</tr>
<tr>
<td>KAT Implants™</td>
<td>2.5, 3.0 mm</td>
<td>10, 12, 14 mm</td>
</tr>
<tr>
<td>Megagen</td>
<td>1.6, 2.0, 2.5, 3.1 mm</td>
<td>10, 13, 15 mm</td>
</tr>
<tr>
<td>OCO Biomedical</td>
<td>2.2, 2.5, 3.0 mm</td>
<td>10, 12, 14, 16 mm</td>
</tr>
<tr>
<td>Simpler implants</td>
<td>2.5, 3.25 mm</td>
<td>6, 8, 10, 13, 15, 18 mm</td>
</tr>
<tr>
<td>Zimmer</td>
<td>2.2, 3.25 mm</td>
<td>10, 13, 15 mm</td>
</tr>
</tbody>
</table>
duplicator is opened, and the denture is removed from the alginate.

Clear orthodontic acrylic (from Lang™ Dental, in this case) is mixed to a thin consistency and poured into the mold formed in the duplicator, which is then closed and immersed in hot water. Immersion in hot water accelerates the set of the acrylic and provides a transparent denture replica when completed. After setting of the acrylic, the clear replica denture is removed from the duplicator, and the flanges are adjusted to remove any flash of material. Vertical grooves were made on the buccal/facial surface at the sites deemed ideal for implant placement, and then, short pieces of wire were fixated in the grooves to act as radiographic markers. A panoramic radiograph was obtained, and the location of vital structures such as the maxillary sinus or the mental foramina are identified in relation to the locations of the intended implants. Any modification of the implant locations relative to anatomic structures could be made at this time.

When the final implant locations are verified, the tooth at each implant site on the clear duplicate denture stent is marked with a Sharpie® marker. A 3/32-inch twist drill is used to place a
Figure 11: ERA Mini™ implants placed in the maxilla ready for placement of the mini ERA attachments into the fixtures.

Figure 12: Plastic paralleling heads attached to the ERA Mini™ attachments are used to align the attachments, which are luted into the ERA Mini™ implants. Note the mark on the fixture and angled ERA Mini™ attachment used to get desired position when luting.

Figure 9: The ERA Mini™ implant is picked up on the handpiece placement tool.

Figure 10: The ERA Mini™ implant is introduced and seated to depth intraorally.

Figure 13: Three ERA Mini™ implants shown in the anterior with angled heads, and ERA Mini™ implants with 0-degree attachments in the posterior bilaterally.

Figure 14: A clear vacuform template was fabricated on the model, and markings were made at the sites of the proposed implant sites.

pilot hole through the clear stent into the underlying stone model. The stent is removed from the cast, and the pilot holes in the cast are checked to verify that it is at the center of the crest, and any corrections are made at this time to the pilot holes on the stent.

The surgical stent is tried intraorally, and the occlusion opposing the arch is verified. Local anesthetic is administered via infiltration into the buccal vestibule from the distal of the far right implant position through the distal to the far left implant position.

A simplified surgical armamentarium (Figure 4) makes placement easy for the novice implant surgeon or experienced implant placer. A 1.6-mm pilot drill is placed into a surgical headpiece, and then introduced through the surgical stent at each site, piercing the soft tissue and entering the crestal bone 3-4 mm with sterile water irrigation (Figure 5). The surgical stent is removed, and the perforation through the gingival tissue at the implant sites is evaluated for buccal-lingual orientation.

At each site, a stationary pilot drill is used to explore the osteotomy at the locations to verify that the buccal plate had not been perforated. Paralleling pins are placed into the sites, and the pilot holes are deepened to a depth of the implants to be placed.

A 3-mm disposable tissue punch is pressed over each perforation to the osseous crest, and a gingival tissue plug is removed (Figure 6).

Paralleling pins are again placed
into the implant sites, and the countersink bur for the 3.25-mm ERA Mini™ implant is utilized at each site (Figure 7). In narrower ridges, a 2.2-mm diameter fixture may be selected. When higher bone density is encountered, it may be necessary to use the 3.25-mm bone tap run at 45 Ncm and 20 rpm to allow placement of the implants to the desired depth (Figure 8).

An implant carrier was placed onto the implant handpiece, and torque was set at 45 Ncm and a speed of 20 rpm. The implant package is opened, and the sterile titanium cylinder containing the ERA Mini™ implant is removed. The implant carrier is snapped onto the end of the mini implant (gold-nitrite-coated portion) and is removed from the titanium sleeve (Figure 9). If angle correction is required, the 3.25-mm ERA Mini™ implant may be used, which allows 0, 5, 11, and 17 degrees of correction with lutable attachment heads. If no correction is anticipated, the single-piece ERA Mini™ implant may be used. Angle correction is not currently available with the 2.2-diameter ERA Mini™ fixture.

The implant is carried to the osteotomy site and, under irrigation, the implant is rotated apically either until the surgical unit stops at 45 Ncm, or the correct depth is achieved (Figure 10).

When depth is not achieved with the handpiece, a mini torque wrench is placed fully on the ERA attachment of the mini implant, and a clockwise rotation is applied until the implant reaches correct depth. Use of the mini wrench verses a standard torque wrench decreases the forces placed on the mini implant due to the shorter level arm of the wrench and eliminates any deformation of the ERA attachment that may occur. Placement of the ERA Mini™ implants continues until all fixtures are placed (Figure 11).

If the angle-correction ERA Mini™ implant is utilized, then the angle-correction female with the desired angle is placed on a plastic paralleling head and is snapped on the ERA female and then carried to the implant fixture intraorally. When the attachment is positioned at the desired direction, a mark is made on the coronal of the fixture and attachment with a Sharpie® marker. Care should be made not to press the female fully into the fixture at this time. After all of the ERA correction females have been positioned and marked, they are removed from the fixtures. The
receptor on each of the ERA Mini™ implants is air dried and ERA Lock Cement (Sterngold) is dispensed into the receptor area and applied to the threads on the angle correction female. The female is inserted, tapped into the fixture, and rotated to align the previously made mark (Figure 12). Excess resin cement is wiped away with a disposable brush tip, and the auto-curing resin is allowed to set. Upon setting, any residual excess cement is removed with a scaler (Figure 13).

On the patient's cast, a vacuform stent was fabricated prior to the surgical appointment. Marks are made on the cast at the pilot holes made when the clear stent is fabricated (Figure 14). This is taken intraorally and the marks are verified in relation to the actual implant positions (Figure 15). Holes are then made at the verified positions on the vacuform template. The stent is then inverted into the tissue side of the denture, and a black mark is made at each implant location to assist in relief of the denture acrylic in order to accommodate the ERA Micro OV metal housing (Figure 16). The ERA Micro OV males in the metal housing were placed onto each fixture, and the denture was tried-in to verify clearance. Fit at this stage should be passive with no contact with the attachment housing. Pieces of non-latex dental dam with a central hole were placed over each mini implant fixture, and the ERA housing was snapped down over the attachment. The dam will act as a block-out, preventing any acrylic from getting between the implant and soft tissue during pickup in the denture.

The denture is dried, and SternVantage Varnish LC primer was brushed into each receptor site in the denture and light cured for 1 minute. To aid in cleanup of excess material, it is advised to avoid placement of the primer in areas other than the receptor sites. ERA PickUp resin is expressed from an automix syringe into the receptor sites, taking care not to overfill each site. The denture is inserted intraorally, the patient is guided into occlusion, and the resin is allowed to set. The patient is instructed to keep the teeth together without biting pressure to avoid tissue compression that may prevent engagement of the attachments upon reinsertion of the denture intraorally. Because the anesthetized patient will lack proprioception at this stage, it is suggested that when waiting for the acrylic to set, the assistant places a finger under the patient's chin to help him/her remain closed.

Upon setting, the denture is removed, along with the pieces of dam placed earlier. Because primer was not applied outside the receptor sites, removal of excess material requires use of an acrylic bur to expose the rim of the metal housing, and the extra material can be flaked off with an instrument. A Micro core cutter bur was used to remove the black processing male in each housing, and an ERA male was snapped into each location using a Micro seating tool (Figure 17). The denture is then returned to the mouth, and the retention is evaluated (Figure 18).

**Conclusion**

Mini implants can provide improvement in denture retention when the patient's complaint is a lack of retention, but a stable denture can be achieved. The ERA Mini™ implant provides a lower center of rotation than the "O" ring mini implants on the market. This permits greater divergence between fixtures than can be accommodated when "O" ring heads are utilized, and allows less required space within the acrylic of the denture.

**Disclosure**

The authors have no financial connections with any of the companies mentioned in this article.

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**References**


