Miniscrews—a focal point in practice

Six-part series by Dr Björn Ludwig, Dr Bettina Glaal, Dr Thomas Lietz & Prof Jörg A. Liasson—Part V

Therapeutic auxiliary elements

Down in the jungle

The number of dental suppliers worldwide that offer miniscrews has expanded to an estimated $5$ and this number is still growing. Two trends are apparent from the range of products that are currently available.

There are companies that supply miniscrews only in combination with the required insertion instruments. However, miniscrews are only a means to an end where bone anchorage is concerned—an aspect that is far too often overlooked. This is because if the desired therapeutic outcome is to be achieved, appropriate auxiliary devices must also be used (eg springs, elastic chains, wires). For the purpose of a treatment, this means that a range of suppliers must be approached in order to obtain all the elements required for the actual procedure. A potential problem under these circumstances is that the miniscrews and the auxiliary elements may be incompatible. Very few suppliers of miniscrews also offer a complete system.

Such a system consists of diagnostic and therapeutic auxiliary products, in addition to miniscrews (Table 1). In the case of a complete system, it can be assumed that the head of the miniscrew will be compatible with the auxiliary element. The building-block principle can be used to construct an individually tailored appliance from the various elements. The greater the range of auxiliary elements that is available, the more freedom and flexibility these elements afford in a range of applications.

Suppliers of miniscrews who see core business is the orthodontic sector usually also offer the necessary auxiliary products in their ranges. It is both convenient and time-saving for the user when the appropriate products are offered together or are available in sets.

Auxiliary elements for direct chairside use

These auxiliary elements can be divided into three main groups:

- basic elements,
- semi-finished elements; and
- finished elements.

Classification is determined by the extent to which the user has to process or manipulate the element before it can be used.

Basic elements

These consist solely of orthodontic wires (particularly wires with square profiles but also those with round profiles) of various grades and materials. The wires are used to fashion individual auxiliary elements, which can be more or less time-consuming depending on the type of appliance required. The wires (particularly those made of stainless steel) are quite reasonably priced. Round profile wires are mainly used as ligatures, in other words, simply as fixing elements, but if appropriately twisted, they can also be used for traction purposes (Fig. 1). Three-dimensional monitoring of round profile wires is not possible as they offer little resistance to torque. Square profile wires, however, can be subjected to 3-D inspection because they are torsion free & highly stable & provide (depending on their dimensions) for a very rigid attachment between miniscrew and appliance (Fig. 2). It is advisable to use a grade of wire that fills the slot of the miniscrew.

In some cases, it may be necessary to bend a square profile wire. This can be advantageous in mesialisation when a hook can be provided on the pin for attaching a spring or elastic chain and for attachment to the main arch of the appliance. For this purpose, the wire should be bent at a right angle. Bent wires can also be used in another situation. A ligature or a drop of adhesive is used to fix a square profile wire in a miniscrew slot. Depending on the reciprocal forces and the quality of fixation, the wire (square or round profile) can start to slip within the slot. This can readily be prevented by bending the wire, at least if a pin with a cross-slot is used (Fig. 5a).

In these two situations, however, a grade of wire that fills the slot can only be used if the edges of the slot at the point of cross-over are removed. Of the 16 mini-screws with cross-slot bracket heads currently available, this convenient detail is only found in OrthoEasy (FORESTADENT; Fig. 5b) and the tomas-pin (DENTAURUM; Fig. 5c).

Semi-finished elements

These auxiliary elements are generally components that are supplied in a functional form but must be adapted to individual requirements (Table 2). Depending on the type and material of the product, prices are in the moderate range and the time required for preparation is minimal. One example is the uprighting spring (Fig. 4a), which can be used after only a few adjustments. Depending on how the spring is set, lower molars can be straightened and concomitantly intruded or extruded. This auxiliary product is particularly useful in pre-prosthetic procedures in which teeth need to be moved to provide an optimal baseline (Fig. 4b). Crimpable tubes to which square profile wire has been welded (Figs. 5a & b) can be used to attach miniscrews to a pre-existing MBI (multi-bracket) appliance. If a fixed anchorage becomes necessary during treatment, this can be easily implemented using these wire elements without needing to remove the appliance or parts of it. During En Masse Retraction, crimpable tubes with attached wire can be used to fashion individual hooks (Fig. 6). These can thus be used to ensure that the traction force (provided by spring or elastic chain) is applied near the centre of resistance.

There are three companies that offer pre-prepared wire elements, such as the L and U wires (FORESTADENT) and the tomas T wire (DENTAURUM). These elements facilitate the attachment of bands & brackets (Fig. 7a). The tomas T wire (Fig. 7b) with its three arms provides...
for a wide range of possible application combinations. For the purpose of mesialisation, for example, one arm can be bent to form a hook. Another can be attached to the main arch by means of a cross tube. Another variant devised by Dr S. Baumgärtel is the fixation of the anterior teeth to a para-median miniscrew (Fig. 7c).

**Finished elements**

This group covers a whole range of auxiliary products for use in many different applications (Table 5). All of these require little or no time for preparation and can be used directly without adaptive adjustments. However, these products are also accordingly priced relative to type and grade of finish.

**Crimpable hooks**

For the purposes of En Masse Retraction, it is often an advantage when the force provided by spring or elastic chain is applied at the same level as the centre of resistance. This can be readily implemented using ready-made hooks, which are crimped to the arch of the appliance (Fig. 8).

**Compression springs**

Compression springs are also ready-made elements and are sold by the metre. The springs can be used for distalisation and mesialisation. One problem is ensuring continuous activation as the spring effect is lost. Stop element can be incorporated to avoid needing to remove the whole appliance whenever this happens (Table 5). These are available as crimpable elements and as screw stops. The latter have the advantage that they can be quickly adapted to a wide range of situation. When such stops are used, the effort required for the repeated activation of springs is considerably reduced.

**Coil spring elements**

Coil springs are not new in the field of orthodontic treatment. They are generally too small to be attached to miniscrews (Fig. 7b). A firm attachment to the screw head can only be achieved using ligatures or ready-made hooks that allow attachment of the spring to the head. For this reason, several suppliers now offer coil springs (Table 5) with at least one eyelet that is compatible with the head of their miniscrew (Fig. 8). These springs are generally made of NiTi and can be used in many different applications. New on the market are the

### Semi-finished elements which need to be individually adjusted

<table>
<thead>
<tr>
<th>Element</th>
<th>Device</th>
<th>Application</th>
<th>Characteristics</th>
<th>Product name</th>
<th>Available for</th>
<th>Example applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power arm</td>
<td>“En Masse” Retraction</td>
<td>Crimpable tubes with a welded-on wire for individual hook formation. They can be used in certain situations to attach the main arch to a segment of the pin.</td>
<td>tomas®-power arm square tomas®-power arm round Question Hook</td>
<td>tomas®-pin tomas®-pin A-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire elements</td>
<td>Direct anchorage</td>
<td>Prebent/ready-to-use wire elements for attaching pin head and the orthodontic appliance</td>
<td>tomas®-T wire U-anchor Pin-Hook Abutment with wire 0.8 or 1.1 mm</td>
<td>tomas®-pin OrthoEasy® M.A.S. BENEFIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uprighting springs</td>
<td>For the uprighting of molars and, depending on setting, simultaneous intrusion or extrusion</td>
<td>NiTi spring, adjustable attached to a steel wire tomas®-uprighting spring Titanol® Uprighting spring tomas®-pin OrthoEasy®</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Figures: DENTAURUM, FORESTADENT; Layout: DTT)
canines. However, they have (Fig. 9b).

Massee Retraction treatments for the alignment of displaced Figs. 9a, b: The Nikodem spring (a) is available with varying numbers used traction elements. In contrast with NITI springs, how-

The effect of a sliding hook is determined by many different factors, which is why the value of attaching sliding hooks to the arch is disputed.

Auxiliary elements for laboratory use

All the elements discussed above can be prepared and inserted, with varying amounts of time expenditure, directly at the chairside. In recent years, the range of applications for miniscrews has also been extended to skeletal adjustment treatments, such as palatine suture expansion (see Dental Tribune Asia

Pacific, 5(2009): 24). The corresponding appliances require very careful preparation, and for this reason, the related tasks have been transferred to the laboratory. The principal procedure involves the insertion of the miniscrew(s) and the subsequent reshaping process. Once a working model has been prepared, the appliance is constructed and adjusted appropriately.

For connection to a miniscrew, a suitable abutment must be employed. In hybrid PSF, for example, two arms of the expansion screw are welded to the abutment. The laboratory abutments available from FORESTADENT fit the head of the OrthoEasy screw. An adhesive is used for fixture after insertion.

An innovative approach is the BENEFIT-System (Mondial). Analogous to prosthetic implants, an implant is placed in the bone. Instead of the widely known system where the head is firmly bonded to the thread, there are different abutments (Table 5) available. These will be threaded to the bone screw. This way, many installations can be prepared in the laboratory, for example, distalisation, anchoring, and retention RPE, saving chair time. For many mechanisms, such as molar uprighting or intrusion, impres-

Table 3

<table>
<thead>
<tr>
<th>Element</th>
<th>Device</th>
<th>Application</th>
<th>Characteristics</th>
<th>Product name</th>
<th>Available for</th>
<th>Example applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crimpable hook</td>
<td>“En-Masse”</td>
<td>Re traction</td>
<td>Crimpable tube with welded arm for attachment of elastic elements (palatine chains, springs)</td>
<td>tomas®-crimp hook</td>
<td>tomas®-pin Ortho Easy® Orthodontic Mini-Implant Dual-Top® Anchor Screw Abutment Anchor Screw Abutment A-1</td>
<td></td>
</tr>
<tr>
<td>Compression springs</td>
<td>Distalisation, mesialisation</td>
<td>Compression springs NITI NiTi Compression springs</td>
<td>tomas®-compression spring Compression springs VectorTAS™ Delta Spring Ortho Linking Closed Coil Springs NITI closed coil spring Gentle NITI closed coil spring Co il spring</td>
<td>tomas®-pin Ortho Easy® VectorTAS™ Ortho Implant Dual-Top® Anchor Screw Abutment Abutment A-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hook for elastic chains or springs</td>
<td>Mesialisation, “En-Masse”</td>
<td>Re traction</td>
<td>tomas®-hook monkey hook Screwhook</td>
<td>tomas®-pin Ortho Easy® M.A.S. A-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sliding hook</td>
<td>Mesialisation, “En-Masse”</td>
<td>Re traction</td>
<td>Tube with screws or open metal tube for attaching to appliance</td>
<td>tomas®-stop screw tomas®-slotted stop Crimpable stop Crimpable stop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stop elements</td>
<td>e.g. for activation of compression springs without removing the appliance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross tube</td>
<td>Indirect attachment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abutments</td>
<td>Distalisation, palatine suture expansion (PSE)</td>
<td></td>
<td>Labor Abutment BENEFIT-Standard abutment BENEFIT-Abutment with Slot BENEFIT-Abutment with flange BENEFIT-Abutment with wire BENEFIT-Connecting plate with fixing screw</td>
<td>OrthoEasy® BENEFIT BENEFIT BENEFIT BENEFIT BENEFIT</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

About the author

Dr Björn Ludvig can be reached at bludwig@kiefersorthoapde-rum.de.