of anchorage/blocking (e.g., a ligature) must then be used.

In this case, the presence of the primary molars represented a contraindication for insertion on the vestibular side of the premolar region.

The paramedian insertion of two miniscrews has several advantages. Firstly, the miniscrews provide a very solid basis for anchorage of the distalization appliance.

Secondly, they will never impede the movement of the lateral teeth. Even after successful molar distalization, they can be used to stabilize the situation achieved for the remainder of the treatment.

Thirdly, there is no risk of damaging other teeth because of an unfavorable spatial situation and/or incorrect insertion.

One disadvantage of the coupling necessary between the Walde Frog Appliance used (FORESTA-DENT) and the miniscrews (see Figs. 1a–c) is that cleaning becomes difficult. As large areas of the mucous membrane are covered, there is the risk of the development of peri-mucositis. If this develops further into peri-implantitis, premature loss of the miniscrews could result.

A possible future alternative could be the use of “laboratory abutments” (Figs. 2a–d), which contain no plastics and can be used to couple the appliance with the miniscrews hygienically.

Mesialization

One of the most problematic areas of orthodontic therapy is the correction of the anterior displacement of teeth and particularly of jaw segments. It might seem that the availability of miniscrews means that conventional appliances no longer need to be used at all.

However, depending on the baseline situation and the nature of the required correction, the use of a combination of devices and appliances is recommended. This is often advisable and may even be necessary for biomechanical reasons, such as in a Class III situation.

In the case shown in figures 3a–c, forced transverse expansion of the palatine suture was used in combination with mesial traction, applied by means of a Delaire facial mask. The support provided by two miniscrews inserted in the paramedian region redirected the forces of sagittal and transverse movements almost entirely onto the bones. Dental side effects were markedly reduced.

Figs. 1b, 1c: Walde Frog Appliance (FORESTADENT) anchored to two miniscrews (b). Distalization by approximately 6 mm after three months’ treatment, providing sufficient space for the correct repositioning of the canines (c).

Figs. 2a–d: Distalization of the upper laterals. Miniscrews were inserted in the paramedian region (OrthoEasy, FORESTADENT) (a). OrthoEasy with attached laboratory abutments (b). The Frog Appliance was lashed to the laboratory abutments (c). Lateral X-ray showing the ideal positioning of miniscrews, laboratory abutments and Frog Appliance (d).

Figs. 3a–c: Mesialization of the upper molars. Miniscrews inserted in the paramedian region with laboratory abutments (FORESTADENT) and transverse screw with hook for a Delaire facial mask (a). Status after transverse expansion and formation of a median diastema (b). Extra-oral view of the appliance with a Delaire mask (c).

Figs. 4a–c: Space closure in the region of the upper anterior teeth. Diagram showing the anchorage principle (a). Baseline situation: The central frontal teeth were held in place using a steel arch (19 x 25) fixed to a miniscrew with additional frontal dental torque (b). After nine months, the anchorage is stable (c).
**Space closure**

Owing to the availability of miniscrews, new therapeutic techniques can now be used, particularly for the management of the partially edentulous situation that obviates the need for compensatory extractions and the problem of the loss of stability of the units used for anchorage support.

It is here the effect of Newton’s Third Law is particularly apparent, and the interception of the opposing forces is a major consideration within the therapeutic strategy. The orthopedic closure of dental spaces using miniscrews is highly recommended if:

- there are no alternative, viable conventional methods and/or there is insufficient certainty that these will be effective;
- the extensive use of braces is to be avoided for cosmetic or functional reasons;
- a short-term treatment or partial treatment is required that does not involve correction and realignment of the basic dental arch;
- asymmetrical treatments are associated with the risk of midline displacement and the possibility of compensatory extraction;
- or a suitable dental baseline situation is to be created for preprosthetic treatments.

It is important to note that in cases in which space closure treatment is proposed, it must be ensured the patient is aware of not only the costs and risks of the treatment, but also of the available alternative options, such as the use of bridges or implants.

There are three types of space closure:

- **Anterior space closure** (e.g., in displacement of the lateral incisors).
- **Orthodontic space closure** is frequently indicated if there is a gap in the anterior row of teeth, particularly in the region of the lateral incisors.

The undesirable effects of conventional therapeutic techniques are the displacement of the midline and/or negative inclination of the anterior teeth. If miniscrews are used for the stabilization of the median incisors (Figs. 4a–c), such effects can be avoided. A stable, rigid steel arch with a size of at least 0.48 mm by 0.84 mm attached to two miniscrews inserted in the median or paramedian region can be used to stabilize the anterior teeth.

Using the standard vestibular mechanical techniques, the gap can be closed without altering the position of the incisors.

- **En masse or canine retraction** (e.g., where the premolars are missing). Miniscrews can also be used as an aid in this form of treatment (Figs. 5a–e). In contrast with the conventional appliances, there is no loss of anchorage but rather a biomechanical benefit in terms of more favorable direction of forces.
movement of the tooth (or teeth) is possible.

- Space closure in the molar region (e.g., to avoid the need for prosthetic measures). Premature loss of the primary molars has not yet been eradicated despite all the advances made in prophylactic treatments. There may be a need for appropriate therapy, particularly in cases in which the adjacent teeth are not carious (Fig. 6a–c).

What should the patient be offered: implants, bridges or space closure treatment? With a view to the realistic long-term prognosis for the anchorage teeth, conservation of the surviving natural teeth and the minimization of the effects on the existing materials, a prosthetic solution would not appear to be appropriate.

The basic concept of restorative dentistry — first destroy, in order to reconstruct — is frequently not the best solution.

Let us assume that the strategy adopted is to mesialize tooth #27, in order to compensate — using a natural method — for the loss. The skeletal anchorage means that undesirable side effects, such as reciprocal space closure, are avoided. Only a few elements (brackets, springs, etc.) are needed to support the mesial movement.

The treatment remains invisible to the casual observer, while in comparison with the stated alternatives, it is very cost-effective and provides for a high level of conservation of the natural elements. The prognosis for the long-term preservation of the natural teeth is very good.

Vertical tooth displacement

Any displacement of the teeth along the vertical axis can present a cosmetic and/or functional problem. The solution is extrusion or intrusion using skeletal anchorage. This technique is very simple to implement and very cost-effective.

Extrusion

Extrusion using miniscrews may be used for single teeth (Figs. 7a–c) and for groups of teeth (Figs. 8a, b). Trauma had caused the intrusion of tooth #22 (Figs. 7a–c). The tooth was returned to its original position within three months by means of the indirect anchoring of the canine and straight arch technique, in order to extrude tooth #22 (b). Status after three months (c).

The treatment remains invisible to the casual observer, while in comparison with the stated alternatives, it is very cost-effective and provides for a high level of conservation of the natural elements. The prognosis for the long-term preservation of the natural teeth is very good.

- Space closure in the region of the upper laterals. Baseline situation: Teeth #25 and #27 are free of caries (a). Using miniscrews (OrthoEasy; FORESTADENT), it is possible to provide “invisible” treatment (b). Very few elements are required for mesialization (c).

Figs. 6a–c: Space closure in the region of the upper laterals. Baseline situation: Teeth #25 and #27 are free of caries (a). Using miniscrews (OrthoEasy; FORESTADENT), it is possible to provide “invisible” treatment (b). Very few elements are required for mesialization (c).

Figs. 7a–c: Extrusion of a single tooth. Viable lateral incisor following intrusion due to trauma (a). Miniscrew with indirect anchoring of the canine and straight arch technique, in order to extrude tooth #22 (b). Status after three months (c).

Figs. 8a, b: Extrusion in order to close an open bite caused by tongue thrust, with deterioration of the upper jaw. The aim was to extrude the upper frontals over the miniscrew in the lower jaw (a). Status after 12 months (b).

Figs. 9a, b: Intrusion in order to close a tongue and skeletal open bite. Intrusion of the molars was effected using a Titanol Uprighting Spring (FORESTADENT) (a). Status after six months (b).

Figs. 9a, b: Intrusion in order to close a tongue and skeletal open bite. Intrusion of the molars was effected using a Titanol Uprighting Spring (FORESTADENT) (a). Status after six months (b).

- Intrusion

Extrusion using miniscrews may be used for single teeth (Figs. 7a–c) and for groups of teeth (Figs. 8a, b). Trauma had caused the intrusion of tooth #22 (Figs. 7a–c). The tooth was returned to its original position within three months by means of the indirect anchoring of the canine and straight arch technique, in order to extrude tooth #22 (b). Status after three months (c).

Extrusion using miniscrews (OrthoEasy; FORESTADENT) was attached to the capstan of the miniscrew, and the screw was set to intrusion. There was even some over-correction of the positioning of the first molars on both sides after five months’ intrusion, resulting in closure of the frontal bite.

Conclusions

It may be necessary for therapists to overcome logistical and emotional barriers before they can begin to employ miniscrews, but it is only when they are used that their versatility becomes apparent.

Miniscrews make our routine work that much simpler. They enhance the efficiency and effectiveness of many dental appliances, resulting in an overall improvement in treatment quality.

(Editorial note: A complete list of references is available from the publisher. This article first appeared in Dental Tribune Asia Pacific, Vol. 7, No. 4, 2009. The next edition of Ortho Tribune will feature “Part IV — More clinical examples.” All photos were provided by the authors.)