Miniscrews—a focal point in practice

Six-part series by Dr Björn Ludwig, Dr Bettina Glasl, Dr Thomas Lietz & Prof. Jörg A. Lisson—Part III

Miniscrews can be inserted in the vestibular and—as in this example—palatal areas. Vestibular insertion of a miniscrew (e.g. between the premolars) is always associated with the miniscrew’s eventual interference with tooth migration. When this occurs, the miniscrew must be extracted and a conventional form 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 distalisation appliance. Secondly, they will never impede the movement of the lateral teeth. Even after successful molar distalisation, they can be used to stabilise the situation achieved for the remainder of the treatment. Thirdly, there is no risk of damaging other teeth because of an unfavourable spatial situation and/or incorrect insertion.

One disadvantage of the coupling necessary between the Walde Frog Appliance used (FORESTADENT) 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 a conventional form of anchorage (lab abutments) (Figs. 2a–d), which contain no plastics and can be used to couple the appliance with the miniscrews entirely hygienically.

Clinical examples (1)

Horizontal tooth displacement

Lack of space is one of the main reasons for the oblique positioning of teeth. One way to solve this problem is to create the necessary space. Conversely, premature loss of teeth or anatomical abnormalities may result in gaps that require modification for various reasons. For the correction of horizontal tooth displacement, miniscrews can be used, as these produce no undesirable reactive effects.

Distalisation

The first case (Figs. 1a–c) presented involves a frequently encountered problem: the patient’s molars had migrated in a mesial direction. This resulted in a marked loss of space in the region of the canines. The two treatment options in such a case are extraction or distalisation. In this case, distalisation was a viable option and extraction was unnecessary. Conventional techniques for distalisation (apart from the use of headgear) require support from other groups of teeth. Creating anchorage in this way has negative reactive effects. In the example under consideration, it is highly probable that protrusion of the anterior teeth would have resulted, should a conventional method for distalisation have been employed. Such negative results can be avoided by the use of miniscrews.

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Mesialisation

One of the most problematic areas of orthodontic therapy is the correction of the anterior displacement of teeth, and particularly of jaw segments. It could 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 5a to c, forced transverse expansion of the palatine suture was used in combination with mesialisation, 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.

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 purposes. This aspect 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 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 pre-prosthetic treatments.

It is important to note that in cases in which space closure treatment is proposed, it must be ensured that the patient is aware of not only the effect, but also of the available alternative options, such as the use of braces 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 stabilisation of the median incisors (Figs. 4a–c), such effects can be avoided. A stable, rigid steel arch with a size of at least 0.08 mm by 0.06 mm (10 x 25) attached to two miniscrews inserted in the median or paramedian region can be used to stabilise the anterior teeth. Using the standard working and 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–c). In contrast with the conventional appliances, there is no loss of anchorage but rather a biomechanical benefit in terms of more favourable direction of forces. If the miniscrews and the fitting of the active element (transverse spring or elastic chain) are positioned at the same level as the resistance centre of the canines, physical movement of the tooth (or teeth) is possible.

Space closure in the molar region (e.g. to avoid the need for prosthesis measures)

Premature loss of the primary molars has not yet been eradicated despite all the advances made in prophylactic treatments. There may be aneed for appropriate therapy, particularly in cases in which the closure of the first premolar is precarious (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 minimisation 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 mesialise tooth 27 in order to bridge the gap 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 teeth. 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 anchorage of tooth 25 to a miniscrew using a straight wire appliance. In the case of a bite that exposed tongue and bone (Figs. 8a & b), the approach adopted was to provide transverse expansion and extrusion of the anterior teeth. Intermaxillary rubber traction braces connected to miniscrews in the lower jaws were used. If the braces had been connected to the lower anterior teeth, undesirable extrusion of these would have resulted (every action has an equal and opposite reaction). Because of the small root surface, this process would have occurred in a much shorter space of time than in the case of the upper anterior teeth. The opposing bone in the lower jaw prevented this undesirable reactive effect.

Intrusion

This open bite with extrusion of the tongue (Figs. 9a & b) was treated by means of intrusion of the molars and consequent collapse of the maxilla. Miniscrews were inserted in the first and second quadrants in each case between the canine and the first premolar. A Titanol Uprighting Spring (FORESTADENT) was attached to the caput of the miniscrew, and the screw was set to intrusion. There was even some overcorrection 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 logical 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 applications, resulting in an overall improvement in treatment quality.

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