Miniscrews—a focal point in practice

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

Basic information on the insertion of miniscrews

Preparing for insertion

The insertion of a miniscrew is a very simple and rapid therapeutic measure. Although there are several methods that will yield good results, successful insertion requires adherence to a few important principles. The following text details those insertion steps that offer a high degree of safety for both patient and dentist (see checklist for insertion below). It should be noted that this information is generalised and must be adapted to individual circumstances.

Checklist for insertion

Pre-operative planning and preparation:
- Planning documentation (X-ray, situational models);
- Marking of the bone—gingival line and tooth axes on the model, determining the site of insertion;
- Sterilisation of the instruments and preparation of the worksta-
tion.

Anesthetic and assessment of the insertion site:
- Anesthetic;
- Use of X-ray side and control image.

Selection of the screw:
- Measurement of the thickness of the mucous membrane (optional);
- Determination of the length;
- Determination of the type of screw.

Transgingival penetration:
- Excision of the mucous membrane or perforation with the screw.

Preparation of the bone site:
- Optimal marking of the bone and perforation of the bone with deep pilot drilling, depending on the type of screw.

Insertion of the miniscrew:
- Manually or by machine.

Start of orthodontic measures:
- Attaching, and fixing of the linking elements.

Post-operative care:
- Notes on care and behaviour, and check-up dates.

Removal of the miniscrew:
- Removal of the linking elements;
- Removal of the miniscrew.

General notes on insertion

Accurate pre-operative planning is a basic requirement for successful treatment with miniscrews. Such planning includes a comprehensive anamnesis and an accurate assessment of the findings. It is essential that the treatment be thoroughly explained to the patient.

Proper hygiene must be ensured throughout the entire operation. Both the dental chair and the treatment process must be prepared with this in mind. During the insertion of a miniscrew, adherence to all hygiene measures required for an invasive procedure, such as a sterile work environment and gloves, must be ensured. All instruments required for insertion must be checked for completeness, functionality, and sterility. The patient may rinse with a disinfectant solution, or a suitable disinfectant can be locally applied. The patient should then be positioned to ensure a clear view of the operational area and ergonomically facilitate insertion for the treating dentist.

Pre-operative planning

To function correctly, a miniscrew requires firm anchorage in the bone (primary stability) and the positioning of its head in the denser gingival tissue (gingiva alveolaris). The selection of the insertion site must take clinical and para-clinical findings into account (X-ray image, model), as well as the goal of the treatment and the resulting orthodontic apparatus. For interradicular insertion, a bone thickness of at least 0.5 mm around the miniscrew is required. This means that for a miniscrew with an—for many reasons—optimal diameter of 1.6 mm the roots must be at least 2.5 mm from each other. Thus, the bone status and the longitudinal axis of the insertion site must be carefully evaluated.

Basic information regarding this is obtained by carrying out measurements on the model. It often helps to mark the vertical axis of the teeth and the progress of the maxo-gingival line on the model, based on the clinical and radiological findings. This will allow for an improved assessment of the spatial circumstances in combination with the X-ray image. To assist the accurate determination of the insertion site, X-ray aids (Fig. 2.1) are available. Although their use facilitates the selection of the insertion site, they cannot replace other diagnostic measures.

This is because, depending on the positioning of the X-ray tube, object, film, and/or sensor, all types of X-ray devices and images may yield some optical distortion. Interpretation of images can thus lead to false-negative or false-positive results (Figs. 2.2a–c). Therefore, the placement of a miniscrew should always be based on the clinical findings. If a miniscrew is to be inserted into an area in which there is no risk of damage to roots, nerves, or blood vessels (e.g. into the palate just behind the transverse line linking the two canines), the position of the screw may be freely chosen (Figs. 2.5a–c).

Anaesthetic

During the interradicular insertion of a miniscrew, the sensitivity of the periodontal tissue of the adjoining teeth should be retained. For this reason, the following two procedures are recommended:
- a) A low-dose injection of approximately 0.5 ml anaesthetic (Figs. 2.4a & b), and
- b) The induction of superficial anaesthesia of the mucous membrane at the insertion site.

Choice of screw

Measuring of the thickness of the mucous membrane (optional)

A pointed sensor with an attached rubber ring is used to measure the thickness of the gingival tissue in the direction of insertion (Fig. 2.6). This information may be useful when determining the final length of the screw and possibly when inserting the miniscrew. When choosing the length, the bone repository and the thickness of the mucous membrane in the direction of insertion play a role; in the retruminal section of the lower jaw and in the palate, the thickness of the mucous membrane is often more than 2 mm. The part of the miniscrew inside the bone must be at least as long as the part outside the bone. The various dimensions must be taken into account.

The thickness of the bone in the direction of insertion deter-

mines the required length of the miniscrew:
- Bone thickness > 10 mm: mini-
screws with a length of up to 10 mm are to be used;
- Bone thickness < 10 mm and > 7 mm: miniscrews with a length of 8 mm or 6 mm are to be used; and
• bone thickness < 6 mm: mini-
screws cannot be used.

The following guidelines aid
in selecting the length:
• in the buccal region of the up-
per jaw: 8 mm or 10 mm;
• in the palatal region (de-
pending on the region): 6, 8 or
10 mm; and
• in the lower jaw: usually 6 mm
or 8 mm.

Determination of the type
of thread
Self-cutting miniscrews re-
quire pre-drilling (also known as
pilot drilling) appropriate to the
length and diameter of the screw,
as well as to the quality of the
bone. A self-tapping miniscrew
will find its own way into the bone
and requires no pre-drilling
(Figs. 2.7a & b). Bone is more or
less elastic depending on site,
and if thicker bone segments are
involved, the miniscrew must
penetrate the gingival tissue.

Transgingival penetration
The miniscrew must pene-
trate through gingival tissue,
which must thus be perforated
during insertion. Two methods
are used for the perforation of
the gingival tissue:

a) excision of the gingival tissue;
or
b) direct insertion of the screw
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Machine insertion

Machine insertion requires a surgical treatment unit (the torque of which can be controlled) or at least a low-rpm dual green handpiece. Accurate setting of the torque and the number of rotations is required; the rotation rate should not exceed 30 rpm⁻¹, and the torque must be restricted to the maximum load limit of the screw.

Machine insertion helps to achieve a consistent torque during insertion but means that the operator loses perception of the bone. During manual insertion, it is possible to perceive the interaction between the screw and the bone by tactile senses. Insertion by machine is shown in Figures 2.11a–f.

Attaching the orthodontic linking elements

As no healing phase is required, load may be placed on the miniscrew immediately after insertion. The selected linking element must be prepared accordingly and attached to the head of the screw (Fig. 2.12). To avoid damage to the teeth to be moved, the load on the linking element should be between 0.5 and 2 N (about 50 and 200 g).

Basic post-operative care

The healing of the gingival tissue and hygiene status after insertion must be regularly reviewed during the entire time that the miniscrew remains in place. The patient must be informed that any manipulation of the screw head with the fingers, tongue, lips, and/or cheeks should be avoided, otherwise the screw may be prematurely lost.

Removal of the miniscrew

A miniscrew can be removed under local anaesthetic. After the linking elements have been removed, the miniscrew may be removed with the same tools used for insertion. The resulting wound requires no special care and usually heals within a short time.

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