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

• Planning documentation (X-rays, situational models);
• Marking of the mucogingival line and tooth axes on the model, determining the site of insertion;
• Sterilisation of the instruments and preparation of the workstation.

Pre-operative planning

• Anaesthetic and assessment of the soft tissue;
• Anaesthetic;
• Use of an X-ray side; and
• Control image.

Selection of the screw:

• Measurement of the thickness of the mucous membrane (optional);
• Determination of the length; and
• 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 cortical bone or deep pilot drilling, depending on the type of screw.

Insertion of the miniscrew:

• Manually or by machine.

Start of orthodontic measures:

• Stabwound 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 element; and
• 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 anaesthesia 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.

Anaesthetic and assessment of the mucous membrane:

• Anaesthetic;
• Use of an X-ray side; and
• Control image.

Choice of screw

Measuring 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 retromolar section of the lower jaw and in the palate, the thickness of the mucous membrane is usually 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 determines the required length of the miniscrew:

• Bone thickness >10 mm: mini-screws with a length of up to 10 mm are to be used; and
• Bone thickness < 10 mm and > 7 mm: miniscrews with a length of 8 mm or 6 mm are to be used; and
• Bone thickness <7 mm: mini-screws with a length of up to 8 mm are to be used; and
• Bone thickness < 5 mm: mini-screws with a length of 5 mm are to be used.

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) 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, for which a topical anaesthetic gel is suitable (Figs. 2.5a & b). No general anaesthetic is ever required for this procedure.

Miniscrews—a focal point in practice

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

Miniscrews—a focal point in practice

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Fig. 2.2a–c: The top image shows the initial situation. A X-ray pin was inserted into the first and second quadrants of the upper jaw (in the b and c goals) to check the bone site, followed by an X-ray image (Fig. 2.2d) taken in a manner that is clinically safe, but the X-ray image shows damage to the adjoining root in the right-hand quadrant, indicating a false-positive initial interpretation of the situation.

Fig. 2.5a–c: The clinical image shows two miniscrews inserted into the palate in the safe zone to the distal side of the transverse line linking the two canines. The FRS and the PA image confirm the bone support in the insertion region. The FRS and the PA image confirm the bone support in the insertion region.
• 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 to the quality of the
bone structure. However, the
screw diameter, the thickness
of the cortical bone, and the hard-
ness of the bone at the insertion
site limit the extent to which this
method can be used. Without
pre-drilling, the bone will be
strongly compressed during in-
sertion and thus suffer a related
tension stress. This may result in
the cracking of the bone around
the insertion site. When the
miniscrew is screwed into the bone,
it is subjected to high loads.
Depending on the bone quality,
the resistance against insertion,
and the continuity of the rota-
tional movement, high torsional
forces can result. In regions with
thick cortical bone and a much
looser bone structure (e.g. the
upper jaw), the use of self-tap-
ning screws is recommended.
In regions where the cortical
bone is thick and the bone struc-
ture is dense (e.g. the ante-
rior lower jaw) both self-cutting
and self-tapping screws may be used,
in each case following perfora-
tion of the compact bone.

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
through the gingival tissue.

There are currently no pub-
lished studies that investigate the
effect of these two methods on
post-operative problems, histo-
logical effects, and/or the loss
rate of miniscrews.

Preparation of the bone site

Protection of the bone is an
important aspect. Insertion
without pre-drilling results in
tensile stress within the bone,
which may lead to post-opera-
tive complications. Particularly
in the case of crestally placed
screws, bone displacement may
result in a severe expansion of
the periodontium. The thickness
of the cortical bone, especially in
the lower jaw, can have a signif-
icant effect on the torque of the
screw. To ensure that the screw
is not overloaded during inser-
tion, the compact bone of the
anterior lower jaw should be
perforated by pre-drilling as
mentioned earlier. Pre-drilling
should be done at a maximum of
1,500 rpm, using a short pilot
drill and water-cooling to re-
duce the risk of damaging the
root (Figs. 2.8 a & b).

Insertion of the miniscrew

The miniscrew must be re-
moved from its sterile packag-
ing (Fig. 2.9) or the work rack
(Figs. 2.10a–d) without contami-
nation. The thread of the screw
may not be touched. The screw
should be inserted at a constant
rotational speed (at approxi-
mately 50 rpm) and with as uni-
form a torque as possible.

Manual insertion

Manufacturers supply various
screwdrivers and blades in sev-
eral lengths for the manual in-
sertion of the screws. Because of
their dimensions, long blades
pose the risk of attaining a very
high torque during insertion.
Hence, insertion must be carried
carefully to avoid breaking the
miniscrew. Torque ratchets are
available for use with some sys-
tems (e.g. tomas, DENTAURUM;
and LOMAS, Mondeal), which
provide a certain amount of con-
trol over the insertion torque.

Preparation of the work rack

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trol over the insertion torque.
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, 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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