Miniscrews—a focal point in practice

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

In view of the plethora of publications, courses, and advertising material on this subject, it would seem that miniscrews are widely used. Once some candid questions have been asked and answered, however, it becomes apparent that the reality is quite different. It seems evident that there are valid reasons that miniscrews are not yet in daily use in many practices. With this series, the authors intend to encourage those practitioners who are hesitant to use miniscrews to use them routinely, by providing a compendium of experiences and new findings in this field.

The basis and history of anchorage: the selection of screws

Anchorage in general
Moving a body requires anchorage in the form of a counter support. The force required for the movement acts on both body and abutment. In his Third Law (1687), Newton specified that every action has an equal and opposite reaction. In dentofacial orthopaedics, this means that the force acts on all teeth involved in the case of the dental support of a tooth movement. Thus, both bodies ultimately move. The extent of movement and counter-movement does, however, depend on the anchorage strength of the individual teeth, ie, on the number and length of the roots, the root surface, and the structure of the surrounding bone.

Anchorage quality can be divided into three categories:
1. minimum anchorage;
2. medium anchorage; and
3. maximum anchorage.

These three categories can be described using the example of a conventional canine retraction after removal of a first premolar (Figs. 1.1).

In the case of minimal anchorage, the support is provided by the individual teeth. Figure 1.1a shows that a single premolar is not sufficient as an abutment to distilise a canine. The premolar is clearly mesialised in reaction to the application of force. Figure 1.1b shows how two, equally strong, anchorage segments are formed. Action and reaction are comparable in this case; the result is reciprocal tooth movement. In the case of maximum anchorage (Figs. 1.1c), the posterior group of teeth is secured and held stationary by using a miniscrew.

The canine can be retracted by the complete force vector, as the reactive force is completely absorbed by the anchorage block formed. Apart from anchorage quality, the basis, ie, the type of anchorage location, plays a role:
1. dental or desmodontal support:
   • use of additional intra-oral devices (nance, palatal arch, lingual arch, lip bumper);
   • modification of fixed appliance (buccal root torque, blocking); and
   • incorporation of the teeth of the other jaw (Class II or III elastic bands).
2. extra-oral support:
   • headgear; and
   • face mask.
3. intrusional support:
   • implants, miniscrews, etc.

This article only deals with anchorage in bony structures. The terms skeletal or cortical anchorage are used interchangeably in this case.

History and overview of skeletal anchorage
Bony anchorage has its roots in Gainsforth’s unsuccessful attempt to insert screws into the jawbone as load anchors in 1945. Many later experiments were unsuccessful and the method had become obsolete by the late 1970s. From 1980 onwards, various research groups (such as Creekmore, Boberts, and Turley) took up the subject once more. Creekmore published the first, clinically successful patient treatment case.

There are now numerous options for cortical anchorage (Fig. 1.2), including (artificial or pathologically) ankylosed teeth on the basis of miniplates normally used in cranio-maxillo-facial surgery and the use of prosthetic implants. Wehrbein and Glatzmaier were the first to present an implant system specifically designed for these purposes.

Fig. 1.1: After removal of the first premolar, the canine is to be retracted; results for a) minimum, b) medium or reciprocal and c) maximum anchorage.

Fig. 1.2: Overview of the range of cortical anchorage options.

Fig. 1.3: Clinical example of two typical miniscrew treatment applications: a) gap closure, b) straightening of tooth No. 7.

Fig. 1.4: One-sided gap closure in the left lower jaw. Miniscrews prevented the expected reactive side effect of subsequent shifting of the middle line.

Figs. 1.5: Eight examples of the over 700 different forms of miniscrews currently available (from left to right): Ortho easy (FORESTADENT), Aarhus Mini Implant (Medicon), Abou Anchors (Dentos), Dual Top (Jeil Medical), LOMAS (Mondeal), Osas (Dewimed), Spider Screw (HDC), and tomas-pin SD (DENTAURUM).