The Canine and Premolar Area

Fractures behind the mental foramen can be sufficiently stabilized by only one plate. In this area there are two anatomical danger points. The apex of the canine is normally long and may lie close to the osteosynthesis line. Therefore, it is necessary to make sure that the drill holes are placed beside the apex and do not damage them. If this is not possible with a simple four-hole plate, a four-hole plate with bar should be used (Fig. 7.9). In most cases this allows the correct positioning of the drill holes. The nervus mentalis lies below the osteosynthesis line. It emerges from the mandible between the apices of the two premolars through the foramen mentale. If care is not taken, the mental nerve may be damaged by the application of the plate. It is therefore advantageous to place the concave section of the plate between the screw holes exactly over the exit point of the nerve (Fig. 7.10), or to bend the plate in an edgewise direction over the exit point. With a fracture situated at the mental foramen, a second plate below the nervus mentalis can be necessary if some torsional instability is detected on checking the osteosynthesis.

The Molar Area and the Angle of the Mandible

If the mouth is small and the intraoral application of a drill and screwdriver becomes too difficult, either an angled screwdriver or the transbuccal approach can be used. After puncturing the soft tissue of the cheek, transbuccal instruments will facilitate the use of the drill and avoid injury to the cheek (Fig. 7.11).

In a fracture at the angle of the mandible, the plate should be located on the proximal fragment medial to the oblique line, so that it is bent over the surface and the proximal screws are placed in a nearly sagittal direction. The two screws in the distal fragment can then be fixed in a more horizontal direction (Figs. 7.12, 7.13). In certain cases—with simultaneous fractures of the alveolar process or when an impacted wisdom tooth is present—the plate may be fixed to the outer surface of the mandible, corresponding in position to the course of the tension line (Fig. 7.14).
Different Areas Require Special Measures

Fig. 7.11 Transbuccal approach with instruments.

Fig. 7.12 Plate fixation at the angle of the mandible. Control of the position.

Fig. 7.13 Plate fixation at the angle of the mandible. Drilling of the first hole.

Fig. 7.14 Plate fixation at the outer surface of the mandible.
Fig. 10.5 Symphysis and parasympysis fractures: proper placement of the drill guide and pointer. The tip of the pointer extends 15 mm beyond the fracture and is in contact with the lateral surface of the mandible. The undersurface of the pointer must maintain contact with bone during the drilling process.

Fig. 10.6 Anterior body fractures: proper placement of the drill guide and pointer. The tip of the pointer extends 15 mm beyond the fracture and is in contact with the inferior border or lingual surface of the mandible. The pointer is angled to allow the drill to pass below the neurovascular bundle. The undersurface of the pointer must maintain contact with the lateral surface of bone during the drilling process.

Fig. 10.7 Posterior body fractures: proper placement of the drill guide and pointer. The tip of the pointer extends 15 mm beyond the fracture and is in contact with the lingual surface of the mandible. The beveled end of the drill guide is in contact with the lateral surface or near cortex. The undersurface of the pointer maintains equal contact with the inferior border of the mandible during the drilling process. This ensures that the drill bit passes below, and avoids injury to, the neurovascular bundle (this should not be attempted in cases where there is a low-lying nerve).
Condylar Neck Fractures

Condylar neck fractures can be approached transorally and fixated using a lag screw if they occur low into the ramus and are not sagittal. An anterior approach is used (Figs. 10.9, 10.4).

Complications

The guided lag screw technique accurately and predictably places screws, avoiding injury to important anatomical structures. However, the system has no emergency screws. In situations where the screw has lost retention, another screw or fixation device may be applied around it. Once the fracture has been secured, the loose screw is removed. In situations of unstable fractures, a period of intermaxillary fixation may be required for healing.
Fig. 13.9 Repositioning a medially luxated condyle through a preauricular approach. Inferior traction of the mandible is accomplished through a clamp placed percutaneously, which the assistant pulls downward (after Jacopo Tintoretto, Portrait of a Senator, ca. 1580, Foundation Museum Bornemisza, Madrid).

Fig. 13.10 The condyle is now repositioned and intermaxillary fixation is applied (after Jacopo Tintoretto, Portrait of a Senator, ca. 1580, Foundation Museum Bornemisza, Madrid).

Fig. 13.11 Miniplate osteosynthesis with a six-hole plate. A transcutaneous trocar is used to facilitate the placing of the three inferior screws.

Fig. 13.12 Miniplate osteosynthesis with two miniplates.
Complications

Problems such as limited opening interfering with function, occlusal shifts, late arthritic changes, dysfunction, and deformities such as asymmetry and open bite have been previously noted. Such problems have also been noted with closed reductions (Jeter and Hackney, 1992). Hemorrhage and development of a hematoma are possible. Some patients have motor weakness of the lower lip at the immediately postoperative stage. This damage is temporary and is most likely caused by tension in the surrounding soft tissues during the surgical procedure. No damage to the facial nerve has been observed in any cases operated on via the preauricular approach. The risk of auriculotemporal syndrome in connection with a preauricular approach is low (Swanson, Laskin and Campbell, 1991). Postoperatively, partial resorption and positional changes of the condylar head are possible (Ellis, Simon, and Throckmorton, 2000; Sugiura et al., 2001). The most severe complication was described by Iizuka et al. (1991). One patient had persistent joint pain and limited mouth opening with a total condylar resorption and plate fracture after extraoral miniplate osteosynthesis, which made a subsequent arthroplasty with an autogenous costochondral graft necessary. Plate fracture is considered to be caused by an alteration of the condylar position, as a result of incorrect fracture reduction and unphysiological functional loading.

Fig. 13.13 Another alternative is an L-shaped plate, which can be applied without the use of a trocar.
Fig. 15.6 The delta-shaped plate is placed via the transoral port at the lateral surface of the proximal fragment. Inset: Transbuccal insertion and fixation of the first screw.

Fig. 15.7 The second hole is prepared cranially to the first screw in the proximal fragment, and the screw is inserted. Inset: Insertion of the second screw.
Fig. 15.8 Fine tuning of fracture reduction under endoscopic control. The screwdriver, which is pressed into the screw head of a screw already driven in, is used to manipulate the proximal fragment, while the mandible (distal fragment) is positioned using the towel clamp gripping the angle of the mandible. The first (anterior) hole in the distal fragment is drilled. Inset: Screwdriver inserted in the screw head, right-angled drilling of a hole in the distal fragment.

Fig. 15.9 Alternative manipulation of the proximal fragment and delta-shaped plate together, using a special retractor inserted in the plate via the transoral port, and right-angled drilling of the first hole in the distal fragment. Inset: Screwdriver inserted in a screw head; right-angled drilling of a hole in the distal fragment; special retractor pulling the plate.
orbital ethmoidal cells are removed (Sailer and Landolt, 1987a,b).

The osteotomies through all orbital walls are performed behind the greatest diameter of the orbital contents; sometimes it is necessary to connect the osteotomies of the median orbital wall and the orbital floor via a transconjunctival approach (Sailer, 1978). The zygomatic complex is divided transversely, in an infraorbital direction (Fig. 26.3). The zygomatic osteotomy is completed below the infraorbital foramen into the piriform aperture beneath the lower turbinate, using an intraoral upper vestibular approach. A triangular piece of bone above this osteotomy is removed from both sides of the piriform aperture. Both orbits are gently mobilized by finger pressure and by the use of broad chisels placed into the lateral orbital osteotomy.

Now, two wires are placed within the glabella region and both orbits gently pulled and pressed together. The fixation of the supraorbital bandeau to the orbits and the calvaria is done mostly with titanium wires. A few miniplates can be used, preferably at the lateral orbital rim, in the zygomatic area for fixation of the lyophilized bone grafts (Sailer, 1992), and in the infraorbital region (Fig. 26.4).

In children we prefer to use resorbable plates and screws, because contour corrections are necessary later, which would require removal of often-oseointegrated titanium plates, causing loss of bone. The defects in the cranial base and orbital walls are bridged by lyophilized cartilage slices (Sailer, 1992). The nasal frame work is reconstructed by an L-shaped strut of calvarial bone, which is fixed firmly to the glabella region by two mini-screws (see Fig. 26.4).

At the end of surgery the surplus skin in the frontal and nasal area is excised along the median transnasal–transfrontal incision.

**Correction of Craniosynostosis**

The correction of the fronto-orbital area in a syndromal or nonsyndromal craniosynostosis condition is based on the work of Tessier (1967) and Marchac et al. (1974). The most common fronto-orbital corrections have to be performed in scaphocephaly, frontal plagiocephaly, trigonocephaly, and brachycephaly. The principles of correction of occipital scaphocephaly and occipital plagiocephaly (Sailer and Landolt, 1991) are described later.

Craniosynostosis corrections are usually performed during the first years of life when skull growth is fast. Clinical experience has shown that metallic plates on outer skull surfaces disappear in the intracranial direction by outer bone apposition and inner calvarial resorption. Finally, the plates and screws are lying on top of the dura and screws can penetrate into it. For this reason metallic plates on the growing skull have to be removed approx-
imately 6 months after surgery—or resorbable plates and screws should be used. From our point of view, titanium miniplates should always be removed (Rosenberg et al., 1993) because a metallosis is possible.

We started the application of resorbable osteosynthesis materials in infant craniofacial surgery 20 years ago (Ill et al., 1989), and developed several materials for the cranio-maxillofacial region (Haers et al., 1998; Haers and Sailer, 1999; Sailer et al., 1998).

We consider this technique nowadays to be state of the art (Sailer, 2000) in pediatric craniofacial surgery.

**Fronto-Orbital Corrections**

The correction of a trigonocephaly condition is described as a typical example of fronto-orbital osteotomies. The aim of the procedure is to advance the supraorbital rims and the lateral forehead areas, in particular, to achieve a rounded natural skull form (Figs. 26.5, 26.6).

After the coronal incision the forehead, the supraorbital rims and the nasal structures (without detaching the inner canthal ligaments) are all exposed and the craniotomy and a supraorbital bandeau are outlined (see Fig. 26.5). For safety reasons, burr holes are placed laterally, away from the expected course of the superior sagittal sinus system (see Fig. 26.6). Usually, six burr holes are made, though sometimes a maximum of eight is necessary. The most important part is the fronto-orbital bandeau; the osteotomies run over the fronto-nasal suture, along the anterior part of the orbital roof, through the zygomaticofrontal suture and from there far backward within the frontal, sphenoidal, temporal, and parietal bones, depending on the direction of the chosen osteotomy (see Fig. 26.5).

The fronto-orbital bandeau is totally removed and fashioned according to the desired plan. First, the inner cortex of the glabella region is cut vertically to allow the supraorbital rims to be bent outward easily. Then, with a bone forceps, the lateral supraorbital area and the finger-like extension of the bandeau are bent to the planned shape. The supraorbital bandeau is fixed to the nasal structure by a titanium microplate (Champy et al., 1977), or titanium wiring, or the smallest resorbable plates avail-