Distraction
Osteogenesis

The Riediger Midface Distractor
Internal distraction of severe mid-facial hypoplasia
Schematic Lateral View

Fig. 1: Schematic lateral view post-op

Fig. 2: Schematic lateral view post-distr

Clinical Examples

Fig. 3: Pre-op view I

Fig. 4: Pre-op view II

Fig. 5: Post-distr view I

Fig. 6: Post-distr view II
Introduction

The therapy of cases with severe midfacial hypoplasia (i.e. Crouzon’s disease and other syndromes, posttraumatic cases) continues to be a problem in cranio-maxillofacial surgery. Le Fort III osteotomy and other surgical procedures may offer a solution in those patients. However the amount of ventral move might be restricted due to anatomical limitations (optical nerve) and postoperative retro-maxillary scar formation, especially in children.

Distraction lengthening, a technique first described by Codivilla in 1905, delineates a method for generating new bone by stretching or lengthening of callus. This concept was popularized by Ilizarov who recognized the inherent capacity of the callus tissue. Bone lengthening by distraction osteogenesis through gradual distraction is a well-known procedure for the reconstruction of the mandible. Midface distraction osteogenesis has some distinctive advantages when compared to conventional treatment.

First of all there is no need to use and harvest bone transplants. This means less operating time and less morbidity. Also earlier correction of severe midfacial retrusion becomes possible. Unlike conventional osteotomies, osteotomies with distraction osteogenesis can be performed very early in childhood. This means less psychological problems and earlier correction of the deformity. Midfacial Le Fort III advancement for the correction of midfacial hypoplasia by distraction osteogenesis has been used by some authors. The extra-orally applied halo frames are sometimes not well accepted by the patients because they limit, especially children, in their daily activities such as sport. Internal devices, developed by several authors, have the drawback that they don’t allow precise advancement of the osteotomized segment and closure of the open bite which often accompanies midfacial hypoplasia treatment.

The Riediger Midface Distractor was developed to overcome these problems.

The new design allows for easy internal fixation and temporal positioning with convenient activation of the device.

Indications:

Midfacial retrusion and hypoplasia due to trauma or congenital deformities whereas correction by a (modified) LeFort III advancement is necessary.

Contra-indications

• In cases where there is insufficient bone volume or quality for a secure planning of the distraction.

• A general contra-indication is a severely diseased system: immune deficiency – irradiated patients – severe diabetes.

Developed in cooperation with

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Design of the distractor

The distractor is fabricated out of medical grade titanium in two versions, one for the right side and one for the left side. It consists of a distraction cylinder with an internal expansion system and a lateral activation rod (Fig. 1). Five clockwise turns of 360° each of the activation rod gives a distraction distance of 1 mm. At the posterior end a malleable mesh plate with 18 holes and at the anterior end a tilttable plate with 4 holes is connected. The distractor is thus designed to allow a stable fixation to the bony segments. The connection at the posterior end allows rotation of the distraction cylinder in a lateral plane. At the posterior temporal side, the distractor can be fixated with a maximum of 18 short, monocortical 1.5 mm micro titanium screws of 3 mm length. Longer screws are not advised due to the possibility of perforating and harming the dura mater in cases of thin temporal bone, especially in children. The anterior plate can be fixated with longer, bicortical screws in the frontal process of the zygoma. The connection to the anterior plate is composed out of a ball joint and allows rotation in the sagittal plane. This ball joint facilitates adjuvant orthodontic therapy. Being a unique and patented feature, the lateral activation rod is constructed perpendicular to the distraction cylinder and is accessible through a small cutaneous incision in the pre-auricular area. A small soft tissue protection sleeve can be mounted onto the lateral activation rod in order to allow activation. After the distraction phase has come to an end, the soft tissue protection sleeve can be removed and the distraction device becomes fully submerged. The soft tissue protection sleeve is available in three different lengths (6, 9 and 12 mm). The distractor is available with two different distraction lengths (15 and 20 mm).

Advantages

• Miniaturized internal (subcutaneous) system that is almost invisible and doesn't interfere with daily activities
• Lateral activation of the distractor facilitates the procedure for the patient
• Design allows adjuvant orthodontic therapy and maximum steering of the occlusion
• Design makes a stable positioning and functioning of the distractor possible (fixation with multiple screws)
• Specially designed 1.5 mm micro screws (monocortical) allow stable fixation to the temporal bone without perforating the temporal bone and harming the dura mater
• The soft tissue protection sleeve can be removed after distraction and the device becomes fully submerged. The chance for infection and necessity for early removal of the device are therefore minimal.

Special notes

Prior to implantation, a 3D-CT scan and/or the production of a stereolithographic model is advisable in order to define the optimal position and vector of the distractor and to check the thickness of the temporal bone.
Intra-operative approach

Insertion of the distractor
A bicoronal scalp incision gives wide exposure of the orbits, nose and subtemporal fossae with direct access to the retromalar areas as necessary for the Le Fort III approach. Osteotomies are made across the frontonasal juncture and medial walls of the orbits behind the lacrimal crest with the microsaw and osteotome. Subsequently the midface has to be mobilized with disimpaction forceps and slightly advanced forward. Two distractors (one at the left side and one at the right side) are positioned and fixated. The distractors can be fixated in the temporal area with short 1.5 mm titanium micro screws. The anterior plate can be fixated with longer titanium screws. Pre-operative and intra-operative test activation of the distractors must be performed in order to check the function of the devices. In case of hemifacial deformities such as hemifacial microsomia, a hemifacial osteotomy of the orbit, zygoma and maxilla with the appliance of one distractor may be performed. A prophylactic antibiotic scheme, starting at the induction, for at least two days is advised in order to minimize the risk of infection.

Distraction protocol
- 0.5 or 1.0 mm distraction per day in one or two sessions
- Latency period: 1 week
- Stabilization / Retention time: 3-6 months

Activation of the distractor
After a latency period of one week, a small incision in local anesthesia in the pre-auricular area can be made to expose the lateral activation rod, which is easily palpable subcutaneously by this time. The soft tissue protection sleeve has to be screwed onto the activation rod in order to start distraction. Latency time and distractor activation follows a standard protocol.

Activation can be started one week after placement of the distractors. A distraction rhythm of 1 mm per day in one session or two sessions can be applied. It is advisable to start up adjuvant orthodontics at this time. After obtaining the planned distraction distance, the soft tissue protection sleeve can be removed and the small wound sutured. In this manner the distraction device becomes fully submerged.

Removal of the distractor
The distractors can be removed three to six months after placement by two small incisions: one in the temporal area and one at the lateral orbital ridge. Regular follow-up with clinical examination and X-ray evaluation is advisable. The distractor is designed for single use only!

Literature References
- Ilizarov GA
  The principles of the Ilizarov method.
- Molina F
  Distraction of the Maxilla.
- McCarthy J.G., Schreiber J., Karp N. et al.
  Lengthening of the mandible by gradual distraction.

Ident number:
On each label one will find an ident number. In case of complaints please use the indicated numbers for traceability. It is advisable to attach the ident number to the patient’s file.

Cleaning and sterilization:
The distractor has to be cleaned prior to sterilization by using a neutral cleaning agent. Sterilizing in an autoclave with max. temperature of 134°C is recommended.

Bending procedure:
To avoid mesh plate damage during the bending procedure, please use always two bending pliers ref. no. 25-486-13.