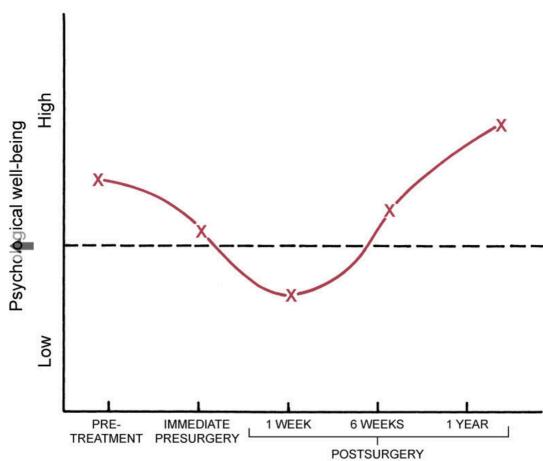


- How well the results match with the tx simulation is an important factor to the patient's reaction after surgery.
- Consider psychological support and counseling.



*A generalized representation of the typical psychological response to orthognathic surgery, based on the work of Kiyak (1992).*

1. *Prior to treatment, patients who seek orthognathic surgery tend to be above the mean on most psychosocial parameters.*
  2. *Immediately before surgery, they are not quite so positive, as anxiety and other concerns increase.*
  3. *In the days immediately after surgery, a period of negativism typically occurs (e.g., depression, dissatisfaction). This is related in part to steroid use at surgery and withdrawal afterward but is not totally explained by this. (steroid withdrawal, even if used on short term, causes mood swings and a drop in most indicators of psychological well-being)*
  4. *By 6 weeks postsurgery, the patients usually are on the positive side of normal again and at 1 year, typically rate quite high for satisfaction with treatment and general well-being.*
- **Body dysmorphic disorder:**
    - Obsessive preoccupation about one's own appearance.
    - 2.4% of the general population.
    - 10-13% of orthognathic patients.
    - Typical signs: Excessive exercising and dieting, multiple surgeries.
    - Unrealistic expectations, satisfaction impossible, chronic depression.
    - Self-infliction (dt. selbstverstümmelnde) plastic surgery attempts.

Computer simulation of alternative tx outcomes

- Computer simulations are helpful for patients to decide between camouflage or surgery.
- Prediction changes for the profiles are reliable, but not for the frontal view.
- Philips, 2003:  
Patients who saw the prediction images before the operation are more likely to be satisfied with their results.  
→ Showing predictions to patients does not lead to unrealistic expectations and disappointments with the actual result in general.

Extraction of teeth and then camouflage versus surgery decision

- The decision must be made before orthodontic tx starts, because the tx is often completely different.
- Cl.III problems are less amenable to camouflage than cl.II.  
(because retracting the lower incisors makes the chin more prominent)

Camouflage

- Extraction spaces are used to produce dental compensation for jaw discrepancies.

#### ORTHODONTIC CAMOUFLAGE OF SKELETAL MALOCCLUSION

##### Acceptable Results Likely

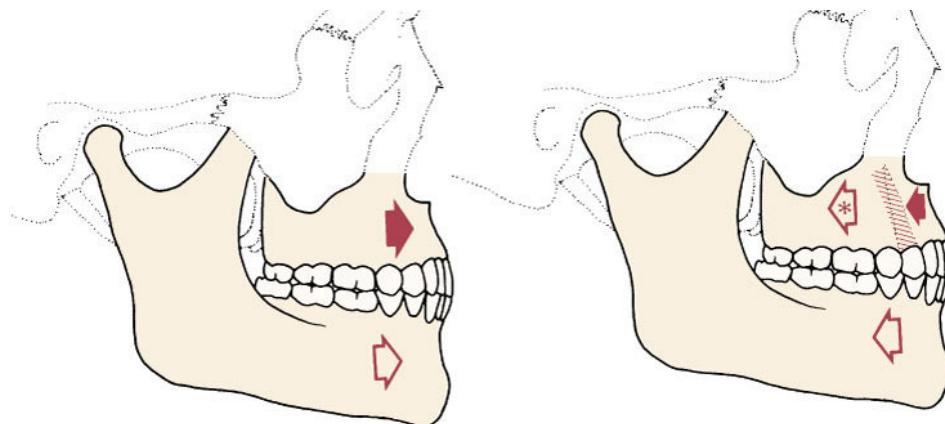
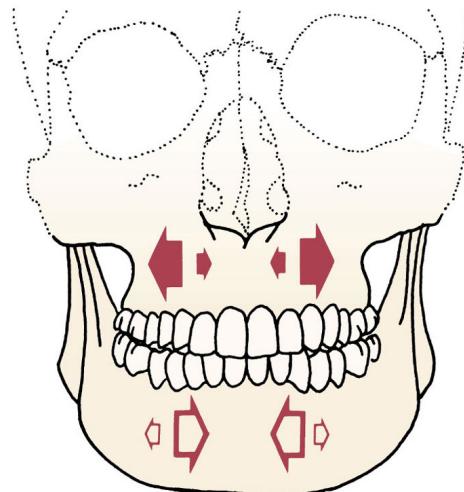
- Average or short facial pattern
- Mild anteroposterior jaw discrepancy
- Crowding <4-6 mm
- Normal soft tissue features (nose, lips, chin)
- No transverse skeletal problem

##### Poor Results Likely

- Long vertical facial pattern
- Moderate or severe anteroposterior jaw discrepancy
- Crowding >4-6 mm
- Exaggerated features
- Transverse skeletal component of problem

## Contemporary surgical techniques

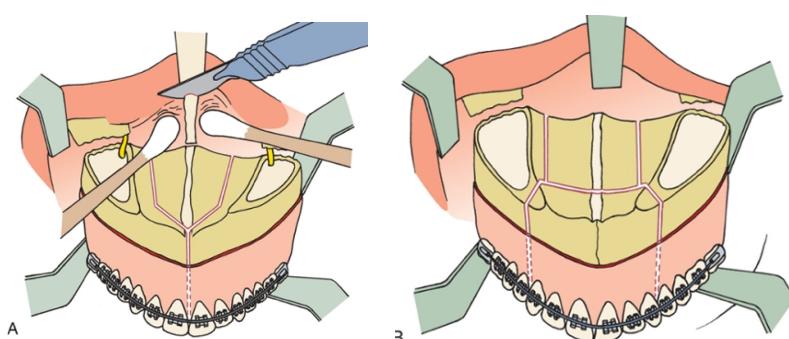
The surgical movements that are possible in the transverse dimension are shown on this posterior-anterior illustration of the skull. The solid arrows indicate that the maxilla can be expanded laterally or constricted with reasonable stability. The smaller size of the arrows pointing to the midline represents the fact that the amount of constriction possible is somewhat less than the range of expansion. The only transverse movement easily achieved in the mandible is constriction, although limited expansion now is possible with distraction osteogenesis.



The maxilla and mandible can be moved anteriorly and posteriorly as indicated by the red arrows in these line drawings. Anterior movements of the mandible greater than approximately 10 mm create considerable tension in the investing soft tissues and tend to be unstable. Anterior movement of the maxilla is similarly limited to 6 to 8 mm in most circumstances - the possibility of relapse or speech alteration from nasopharyngeal incompetence increases with larger movements. Posterior movement of the entire maxilla, though possible, is difficult and usually unnecessary. Instead, posterior movement of protruding incisors up to the width of a premolar is accomplished by removal of a premolar tooth on each side, followed by segmentation of the maxilla. The major limitation of posterior movement of the mandible is its effect on the appearance of the throat. When the mandible is moved back, the tongue moves down as the airway is maintained, and a "turkey gobbler" prominence appears below the chin.

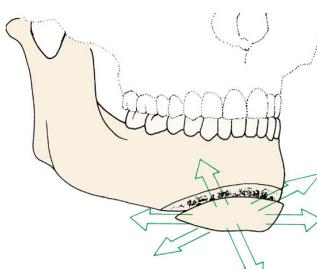
<b>Mandibular Surgery</b> Early 20 <sup>th</sup> century: Body ostectomies for prognathism  1957: Sagittal split ramus osteotomy with IO approach  1990: Rigid internal fixation	<ul style="list-style-type: none"> <li>- <u>Possible corrections:</u> <ul style="list-style-type: none"> <li>• Back → Cave: Tongue moves down = bad appearance eo.</li> <li>• Forward (~10 mm) → Cave: Tension of the soft tissues = unstable.</li> <li>• Rotation.</li> <li>• Moved down anteriorly to increase the mandibular plane angle and the anterior face height.</li> <li>• Narrowing anteriorly (rarely used, requires removal of an incisor).</li> <li>• Rotation of the tooth-bearing segment down anteriorly.</li> </ul> </li>   <li>- <u>Possible corrections with reservation:</u> <ul style="list-style-type: none"> <li>• Up rotation to decrease the mandibular plane angle and decrease anterior face height. → Only stable if the maxilla is moved up posteriorly at the same time so that the rotation does not lengthen the ramus and stretch the elevator muscle.</li> <li>• Widening only with distraction (limitation given by the soft tissue).</li> <li>• Surgery involving the condyles / major advancements:               <ul style="list-style-type: none"> <li>- EO approach</li> <li>- Requires bone grafts</li> <li>- Distraction osteogenesis</li> </ul> </li> </ul> </li> </ul>
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	<ul style="list-style-type: none"> <li>- <b>Sagittal split osteotomy</b> is used nowadays for almost all mn surgeries, because of several advantages to the <b>ramus osteotomy</b>:           <ul style="list-style-type: none"> <li>• Compatible with RIF: → Immobilization of the jaws during healing is not required.</li> <li>• Excellent bone-to-bone contact after the osteotomy minimizes healing problems and provides good postsurgical stability.</li> <li>• Forward &amp; backward movement of the mn is possible.</li> <li>• The tooth-bearing segment can be rotated.</li> </ul> </li> <li>- Lower border osteotomy:           <ul style="list-style-type: none"> <li>• Adjunctive to ramus osteotomy, esp. when the mn is advanced.</li> <li>• Chin can be moved transversely, forward, backward, up and down.</li> </ul> </li> <li>- An asymmetric mn cannot become surgically corrected, if the canines are positioned asymmetric the symphysis.</li> </ul>
<b>Maxillary surgery</b>  1960: Le Fort 1	<ul style="list-style-type: none"> <li>- <u>Possible corrections:</u> <ul style="list-style-type: none"> <li>• Up (excellent stability).</li> <li>• Forward (excellent stability): ~6-8 mm, otherwise risk for velopharyngeal incompetence.</li> <li>• Segmental osteotomy for protruding anterior teeth.</li> <li>• Narrowed.</li> </ul> </li> <li>- <u>Possible corrections with reservations:</u> <ul style="list-style-type: none"> <li>• Down (instable).</li> <li>• Back (difficult, because of structures behind).</li> <li>• Widening (instable): Stretching the palatal mucosa results in an elastic relapse.</li> </ul> </li> <li>- <u>Constriction:</u> Bone removal at the parasagittal osteotomy sites.</li> <li>- <u>Segmental osteotomies:</u> <ul style="list-style-type: none"> <li>• Allow isolated expansion or narrowing of the posterior segments.</li> <li>• Dental relapse is similar to the relapse with SARPE.</li> </ul> </li> <li>- <u>Orthopedic palatal expansion in adolescents:</u> <ul style="list-style-type: none"> <li>• Parasagittal osteotomies (A) in the lateral floor of the nose or medial floor of the sinuses that are connected by a transverse cut anteriorly.</li> <li>• 2-piece osteotomy (A): Midline extension running forward between the roots 1+1. → This is can or cannot be included in a 3-piece osteotomy (B).</li> <li>• <u>Expansion:</u> Harvested bone from the downfracture or bank bone is used to fill the void created by the lateral movement of the segments.</li> <li>• <u>Constriction:</u> Bone is removed at the parasagittal osteotomy sites.</li> </ul> </li> </ul>



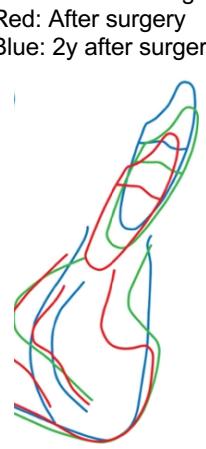
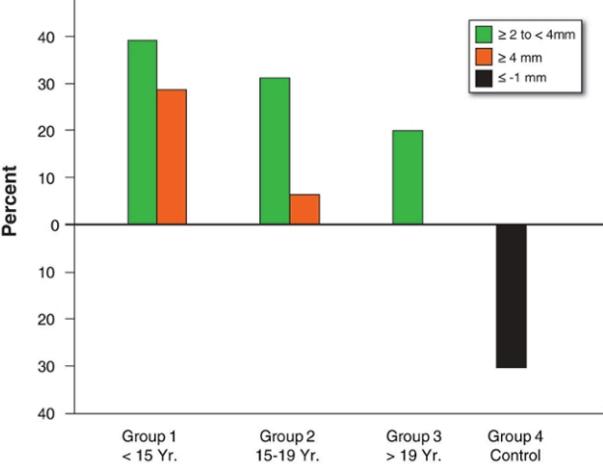
**A:** Maxilla is showed in a downfractured position during Le Fort 1 osteotomy with the lateral para-midline and anterior midline interdental osteotomies to widen the maxilla in 2 pieces and resection of cartilage of the nasal septum so that the maxilla can be moved up.

**B:** Location of lateral para-midline and anterior interdental osteotomies for a 3-piece maxilla. This allows widening posteriorly and differential vertical movement of the anterior and posterior segments.

	<ul style="list-style-type: none"> <li>- <u>SARPE: Orthopedic palatal expansion in adults:</u> <ul style="list-style-type: none"> <li>• Expansion for adults is different due to the increasing resistance from the interdigitated midpalatal and lateral maxillary sutures.</li> <li>• <u>Original approach:</u> Cuts in the lateral buttress (dt. Pfeiler) of the maxilla to decrease resistance, so that the midpalatal suture can be forced open. → Cave: Chance of inadvertent fractures in other areas.</li> <li>• <u>Modern approach:</u> Same cuts like for a Le Fort 1 omitting only the final step of downfracture.</li> <li>• The mx can then be expanded only against soft tissues resistance.</li> <li>• Cave: <ul style="list-style-type: none"> <li>○ No guarantee of symmetric expansion.</li> <li>○ <i>Chamberland, 2011:</i> Relapse of the dental expansion accompanies SARPE and its long-term stability is similar to relapse with a segmental osteotomy. → Additional costs and morbidity of SARPE as a first stage of surgical tx in a patient who would require another operation to reposition the mx is hard to justify.</li> </ul> </li> </ul> </li> </ul>
<b>Chin surgery</b>	<p>1980: Movements of both jaws, the chin and dentoalveolar segments</p>  <p>The chin can be sectioned anterior to the mental foramen and repositioned in all three planes of space. The lingual surface remains attached to muscles in the floor of the mouth, which provides the blood supply. Moving the chin anteriorly, upward, or laterally usually produces highly favorable esthetic results. Moving it back or down may produce a "boxy" appearance.</p> <ul style="list-style-type: none"> <li>- <u>Indication for preliminary SARPE:</u> A maxillary constriction so severe that a segmental expansion of the maxilla in a Le Fort 1 procedure may compromise the blood supply of the segments.</li> <li>- <u>Lower border procedures for chin movement with good esthetic results:</u> <ul style="list-style-type: none"> <li>• Forward</li> <li>• Up</li> <li>• Transverse</li> </ul> </li> <li>- <u>Lower border procedures for chin movement with risk for poor esthetic results:</u> <ul style="list-style-type: none"> <li>• Back</li> <li>• Down</li> </ul> </li> </ul>

<p><b>Dentoalveolar surgery</b></p> <p>1980: Movements of both jaws, the chin and dentoalveolar segments</p>	<ul style="list-style-type: none"> <li>- <u>Segmentosteotomy</u> <ul style="list-style-type: none"> <li>• = Reposition of segments from the dentoalveolar process in all 3 planes of space.</li> <li>• Maximum distances: Few mm (not more than orthodontic movement).</li> <li>• Ideal size: 3 teeth or larger. 2-teeth segments are acceptable, but less predictable.</li> <li>• Blood supply = Collateral circulation via facial and lingual mucosa. → Mucosa must be preserved to maintain tooth vitality and bone integrity.</li> <li>• Segment size ↓ or extent of the movement ↑ → Chance for interrupting the usual blood supply and the collateral supply ↑.</li> </ul> </li> <li>- <u>Tooth vitality:</u> (an osteotomy below the root apices cuts the nerves to the pulp of the teeth in that segment)           <ul style="list-style-type: none"> <li>○ Vital, but denervated pulp after surgery = avital. → Pulp vitality can be demonstrated by the maintenance of either normal pulp temperature (temperature probe) or blood flow (Doppler flow meter)</li> <li>○ Re-innervation often occurs after a few months.</li> <li>○ Pulp vitality is likely to be maintained by blood flow through auxiliary foramina even when the apex is inadvertently cut off.</li> </ul> </li> <li>- <u>Recovery from inadvertent tooth movement:</u> <ul style="list-style-type: none"> <li>• New bone formation can be stimulated with local bone-stimulating hormone therapy and bone grafts: → Fenestrations caused by displaced roots can be corrected.</li> </ul> </li> </ul>
<p><b>Distraction osteogenesis</b></p> <p>21<sup>th</sup> century: Facial distraction osteogenesis</p>	<ul style="list-style-type: none"> <li>- = Manipulation of healing bone. Stretching of an osteotomized area before calcification occurs in order to generate the formation of additional bone and investing soft tissues.</li> <li>- <b>Osteogenesis</b> (formation of new bone) and <b>histogenesis</b> (formation of new soft tissue) occurs.</li> <li>- Creating new bone with distraction is in general more effective than placing a bone graft, but distraction cannot replace bone grafts in all circumstances.</li> <li>- Pro:           <ul style="list-style-type: none"> <li>• Larger distances of movements possible.</li> <li>• Deficient jaws can be increased in size at an earlier age.</li> </ul> </li> <li>- Contra:           <ul style="list-style-type: none"> <li>• Precise movements are not possible: → Often orthognathic surgery is needed later.</li> <li>• 2 operations are necessary for insertion and removal of the distractor.</li> </ul> </li> <li>- Indications:           <ul style="list-style-type: none"> <li>• Moderately severe hemifacial microsomia with a rudimentary ramus on the affected side.</li> <li>• Facial syndromes with <b>severe</b> maxillary deficiency. → Sagittal split osteotomy / Le Fort 1 better indicated for less severe deficiencies.</li> <li>• Widening of the mandibular symphysis with formation of a new periosteum over the distracted area:               <ul style="list-style-type: none"> <li>○ Correction with orthognathic surgery is not possible, because there is not enough tissue to cover a bone graft area.</li> <li>○ No evidence to date that expansion with distraction is more stable than conventional expansion. Cave: Lip and cheek pressure at the corner of the mouth to the canines remains.</li> </ul> </li> </ul> </li> </ul>

### Adjunctive facial procedures:

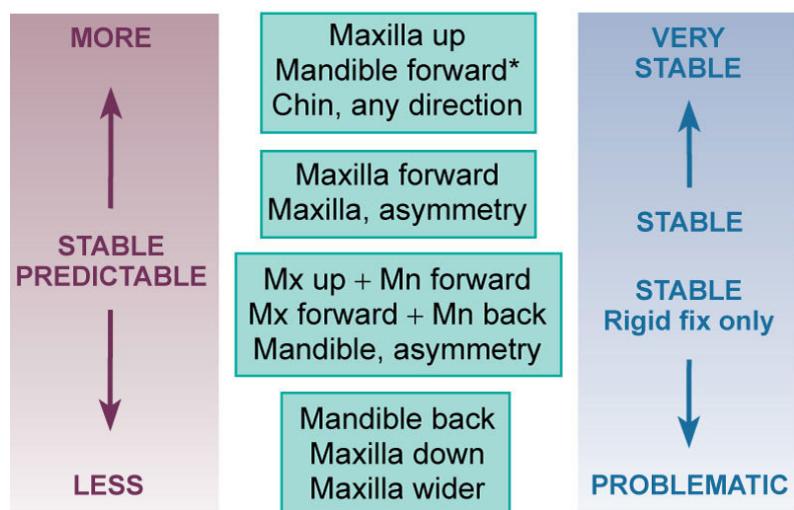
<b>Chin augmentation or reduction</b>	<p><b>- Lower border osteotomy</b></p> <ul style="list-style-type: none"> <li>Preferred tx option. Good predictability and stability.</li> <li>The lingual surface remains attached to the muscles in the floor of the mouth which provide the blood supply.</li> <li>Tightens the suprathyroid musculature: → Desirable changes in chin-neck contour.</li> <li>Allow normal lip function in long-face patients with a simultaneously severe anteroposterior problem → = <b>functional genioplasty</b>.</li> <li>Consider gingival grafting before genioplasty if the attached gingiva is inadequate. (lips closed at rest, lips brought into contact without muscle strain)</li> <li>Bone remodeling thickens the alveolar process below the teeth: The notch above the repositioned chin fills in with new bone that extends up to the alveolar crest, creating new bone in an area where it is needed for future gingival stability.</li> <li>Functional genioplasty and augmentation by sliding the chin forward are more successful if done before age 15. → Eruption of lower incisors after genioplasty ↑ = better formation of new bone above the displaced chin. The eruption of the mn canines sets the limit for the earliest timepoint for a genioplasty, because they are in the way of the osteotomy until they moved into the oral cavity.</li> </ul>																							
<b>Alloplastic implant</b>	 <p><b>Symphysis Thickness Change</b></p>  <table border="1"> <thead> <tr> <th>Group</th> <th>Thickness Category</th> <th>Percent</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Group 1 (&lt; 15 Yr.)</td> <td>≥ 2 to &lt; 4 mm</td> <td>~40</td> </tr> <tr> <td>≥ 4 mm</td> <td>~30</td> </tr> <tr> <td>≤ -1 mm</td> <td>~0</td> </tr> <tr> <td rowspan="2">Group 2 (15-19 Yr.)</td> <td>≥ 2 to &lt; 4 mm</td> <td>~32</td> </tr> <tr> <td>≥ 4 mm</td> <td>~7</td> </tr> <tr> <td rowspan="2">Group 3 (&gt; 19 Yr.)</td> <td>≥ 2 to &lt; 4 mm</td> <td>~20</td> </tr> <tr> <td>≤ -1 mm</td> <td>~0</td> </tr> <tr> <td>Group 4 (Control)</td> <td>≤ -1 mm</td> <td>~3</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>Bone remodeling occurs above and behind the repositioned chin, but the bony chin does not remodel and is remarkably stable over time.</li> <li>Chin advancement &gt; 5 mm in older patients can produce notching with the lateral border of the mandible.</li> </ul> <p><b>Solutions:</b></p> <ul style="list-style-type: none"> <li>Splitting the chin so that the posterior margins can be moved medially to eliminate the notch.</li> <li>Bone graft or alloplastic augmentation materials over the lower border to fill in the posterior notch.</li> <li>Chin reduction is rarely a good camouflage to class III problems: Chin slides only backwards: → The soft tissue chin looks like an underinflated ball because of loss of volume.</li> <li>Vertical reduction of the chin in patients with excessive chin height can greatly increase the facial appearance.</li> </ul> <p><b>- Placement of an alloplastic implant</b></p> <ul style="list-style-type: none"> <li><b>Pro:</b> <ul style="list-style-type: none"> <li>Possibility of removal if the patient is unhappy.</li> <li>Less risk of decreased sensation of the lower lip (trauma to the nerve that emerges from the F. mentale to innervate the lip).</li> </ul> </li> </ul>	Group	Thickness Category	Percent	Group 1 (< 15 Yr.)	≥ 2 to < 4 mm	~40	≥ 4 mm	~30	≤ -1 mm	~0	Group 2 (15-19 Yr.)	≥ 2 to < 4 mm	~32	≥ 4 mm	~7	Group 3 (> 19 Yr.)	≥ 2 to < 4 mm	~20	≤ -1 mm	~0	Group 4 (Control)	≤ -1 mm	~3
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	<ul style="list-style-type: none"> <li>• Contra: <ul style="list-style-type: none"> <li>○ Augmentation only</li> <li>○ Erosion of the implant into the surface of the bone or migration into the neck is possible.</li> <li>○ Newer implant materials placed into a soft tissue pocket rather than directly against the bone provide much better stability and have almost totally replaced silicone. → Removal is however difficult and can result in undesired soft tissue changes.</li> </ul> </li> </ul>
<b>Rhinoplasty</b>	<ul style="list-style-type: none"> <li>- Focus of rhinoplasty: <ul style="list-style-type: none"> <li>• Contour of the nasal dorsum</li> <li>• Shape of the nasal tip</li> <li>• Width of the alar base</li> </ul> </li> <li>- The soft tissue contours follow the jaw movement: → Rhinoplasty can be done immediately after the jaw surgery or as part of the same surgery (technically more difficult, intubation has to be switched).</li> <li>- Le Fort I osteotomy rarely has a positive effect on the nose and may compromises it. In General: <ul style="list-style-type: none"> <li>• Nasal base follows surgical movement 50%.</li> <li>• Nasal tip follow surgical movement 20%.</li> </ul> </li> <li>- Effects of moving the maxilla up and/or forward: <ul style="list-style-type: none"> <li>• Rotation of the nasal tip upward → deepening of the supratip depression.</li> <li>• Widening of the alar base.</li> </ul> </li> <li>- Le Fort II and III move the nose along with the upper part of the maxilla, but the operations bear more risks than a Le Fort I.</li> </ul>
<b>Facial soft tissue contouring with implants</b>	<ul style="list-style-type: none"> <li>- Indications: <ul style="list-style-type: none"> <li>• Paranasal deficiencies in maxillary deficiency patients.</li> <li>• Soft tissue deficiencies which accompany facial syndromes.</li> </ul> </li> <li>- Material: <ul style="list-style-type: none"> <li>○ Paranasal deficiencies: <ul style="list-style-type: none"> <li>■ Patient's own bone.</li> <li>■ Freeze-dried cadaver bone.</li> <li>■ Alloplastic material (=external / inorganic material).</li> </ul> </li> <li>○ Extensive implants needed for patient with congenital anomalies are usually made from alloplastic materials that can be shaped in advance.</li> </ul> </li> </ul>
<b>Lip procedures</b>	<ul style="list-style-type: none"> <li>- <u>Augmentation:</u> <ul style="list-style-type: none"> <li>• Injections of collagen or other materials into the lips: Can be successful, but often it has only a temporary effect.</li> <li>• More stable approach: <ul style="list-style-type: none"> <li>○ Allo Derm (human dermis in sheet form).</li> <li>○ Synthetic materials such as Gore Tex.</li> <li>○ Patients' own soft tissue harvested during a simultaneous face lift procedure. → Material are threaded into a tunnel beneath the mucosa.</li> </ul> </li> </ul> </li> <li>- <u>Reduction:</u> <ul style="list-style-type: none"> <li>• IO incisions parallel to the vermillion border and excision of soft tissue incl. submucosal glands. Removal of muscles is avoided.</li> </ul> </li> </ul>
<b>Submental procedures</b>	<ul style="list-style-type: none"> <li>- <u>Therapeutic approaches to correct a double chin:</u> <ul style="list-style-type: none"> <li>• Removal of excessive submental fat.</li> <li>• Tightening the platysma muscle sling.</li> <li>• Positive effects from mandibular advancement &amp; lower border osteotomy.</li> <li>• Chinwing (<i>Prof. Triaca</i>)</li> </ul> </li> </ul>

## Postsurgical stability and clinical success

<p>Important influencing factors</p>	<ul style="list-style-type: none"> <li>- Factors influencing surgical stability in their order:           <ol style="list-style-type: none"> <li>1. <b>Direction of movement</b></li> <li>2. <b>Type of fixation</b></li> <li>3. <b>Surgical technique</b></li> </ol> </li>   <li>- Stability is greatest when the soft tissues are relaxed during the surgery and least when they are stretched. → Avoid stretching the pterygo-temporalis muscle sling to avoid relapse!</li> <li>- Mn advancement is most stable if the mn is rotated up at the gonial angle and down at the chin to decrease the stretch.</li> <li>- Least stable mn advancement = down rotation of the gonion angle, lengthening the ramus and upward rotation of the chin.</li>   <li>- <b>Neuromuscular adaptions</b> are essentially for stability.</li>   <li>- <u>Mx moved up:</u> <ul style="list-style-type: none"> <li>o → Postural position of the mn alters in concert with the new mx position.</li> <li>o → Occlusal force ↑ = contributes to good stability of the surgery.</li> </ul> </li>   <li>- <u>Repositioning of the tongue to maintain airways dimensions after:</u> <ul style="list-style-type: none"> <li>o Mn setback (no tongue reduction is needed).</li> <li>o Mn advancement (important for patients with sleep disorders).</li> <li>o Lower border osteotomy (tongue is attached to the genial tubercles).</li> </ul> </li>   <li>- <u>Neuromuscular adaptions do not occur when the pterygomandibular sling (elevator muscle) is stretched during mandibular osteotomy:</u> <ul style="list-style-type: none"> <li>o Mn rotated to close an open bite.</li> <li>o Mn advancement.</li> <li>o Mn setback.</li> </ul> </li>   <p style="text-align: center;"><b>→ Movements of the mn that stretch the elevator muscles should be avoided.</b></p>   <li>- No new orientation of the muscle fibers: Neuromuscular adaption affects the length of the masticatory muscles, but not their orientation.</li> <li>- → Successful mn advancement requires keeping the ramus in an upright position rather than letting it incline forward as the mn body is brought forward (the same is true for the reverse).</li> <li>- Tendency to push the ramus intraoperative posteriorly when the chin is moved back and thus changing its orientation is a major cause of instability after operation. → When the jaw function is resumed after the operation, the orientation is restored, and the jaw moves forward again.</li> <li>- Stability of a 2-jaw surgery to correct a cl.III is better than mn setback alone, because it is less prone to push the mn back.</li>   <li>- Surgical widening of the maxilla stretches the palatal mucosa and its elastic rebound is the major cause of relapse tendency.           <ul style="list-style-type: none"> <li>o Overcorrection and careful retention to avoid relapse is mandatory.</li> <li>o SARPE is preferred over a 3-piece approach, if no vertical or anteroposterior changes are needed.</li> </ul> </li> </ul>
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## Surgical-Orthodontic Treatment: A Hierarchy of Stability



\* Short or normal face height only

The hierarchy of stability during the *first postsurgical year*, based on data from the UNC Dentofacial Clinic, Proffit et al., 2007.

- Relapse after surgery occurs normally in a minority of patients → mean values & SD could give wrong impressions → better consider the percentage of patients with sign. changes.
- In this context:
- **Very stable:** = better than a 90% chance of no significant postsurgical change.
- **Stable:** = better than an 80% chance of no change and almost no chance of >2 mm relapse.
- **Problematic:** = some degree of relapse likely and major relapse possible.
- Key procedures in surgical treatment of class II problems are quite stable. (superior repositioning, mandibular advancement, and their combination)
- In class III treatment, maxillary advancement is the most stable procedure, while downward movement of the maxilla and mandibular setback remain problematic.
- Movement of the gonial angles down → relapse tendency ↑↑
- Moving the mn forward or back nearly always causes vertical changes:  
→ The pattern of vertical change is a major determinant of postsurgical stability.
- Stability long-term 1-5 y post-op: (Proffit, 2010)
  - About 20% of the patients who had mn advancement (with or without simultaneously mx surgery), mn length decreases 1-5 y post-tx.
  - After superior positioning of the mx, downward movement of the mx, in what appears to be a resumption of the original growth pattern, leads to >2 mm change in about  $\frac{1}{3}$  of the patients.
  - Clinically sign. changes in the position or dimension of the mx and mn occur in about twice as many patients as similar changes in OJ or OB.  
(adaptive changes of the dentition occur to compensate for the skeletal changes)
  - Cl.III patients who tended to be less stable than cl.II patients in the first year post-surgical show less changes thereafter.

Timing of surgery	
<ul style="list-style-type: none"> <li>- If growth modification is done early, the problems tend to recur because of later growth in the same pattern.</li> <li>- Usual guidance = wait until the adolescence growth spurt to start tx.</li> <li>- Best indication for growth stop: 3 lateral ceph's without discernable changes.</li> </ul>	
<b>Progressive deformity</b>	<ul style="list-style-type: none"> <li>- Early surgery is required in case of a progressive deformity caused by restriction of growth e.g. ankylosis of the mandible.</li> <li>- Goal = Create an environment in which normal growth is possible. (not to correct the deformity)</li> <li>- Causes for mn asymmetry: <ul style="list-style-type: none"> <li>o Congenital anomaly e.g. hemimandibular microsomia.</li> <li>o Old condylar fracture with a limitation on growth from scar tissue that limits translation of the condyle.</li> </ul> <p>→ Indication for a surgical intervention depends on the severity of the problem.</p> </li> <li>- Hybrid functional appliances can help to manage an asymmetry before or after orthognathic surgery.</li> <li>- <b>Hemimandibular microsomia:</b> Timing for the distraction osteogenesis remains controversial, but social acceptability becomes a factor in the decision. → Intervention to advance the mandible often about 6-8 y of age</li> <li>- <b>Hemimandibular hypertrophy:</b> <ul style="list-style-type: none"> <li>• Excessive growth, ø tumor: Normal hard &amp; soft tissue in histologic diagnosis. → Just too much growth = potential to stop growing on its own.</li> <li>• 85% females, 15% males.</li> <li>• In many adolescent girls, a mild asymmetry develops as one side stops growing and the other continues for a while, but then also stops growing.</li> <li>• The excessive growth occurs in 2 patterns at the condyles: <ul style="list-style-type: none"> <li>o Enlargement of the condyle.</li> <li>o Lengthening of the condylar neck. (seems to be more likely to stop, but no evidence)</li> </ul> <p>and 2 patterns in terms of:</p> <ul style="list-style-type: none"> <li>o Lengthening of the ramus versus</li> <li>o Lengthening the body of the mandible</li> </ul> </li> <li>• Patients show all possible combinations of excessive horizontal and vertical growth.</li> <li>• Lengthening of the mn body ↑ → Lateral displacement of the center of the chin ↑</li> <li>• Lengthening of the ramus ↑ → vertical asymmetry ↑ <ul style="list-style-type: none"> <li>o Lower position of one side of the chin than the other.</li> <li>o Asymmetry at the gonial angles.</li> <li>o Canting of the occlusal plane → 2-jaw surgery necessary.</li> </ul> </li> <li>• Removing the condyle on the affected side stops the excessive growth even though the deviant growth pattern affects the rest of the mn, not just the condyle.</li> <li>• <b>Condylectomy</b> is indicated, if the condyle no longer fits into the condylar fossa.</li> <li>• <b>Condylar shave</b> = Removal of the superior surface of the condylar neck where cellular proliferation occurs. → Can be successful if the excessive growth is an elongation of the condylar neck.</li> </ul> </li> </ul>
<b>Symmetric excess growth</b>	<ul style="list-style-type: none"> <li>- Examples: <ul style="list-style-type: none"> <li>o Mn prognathisme.</li> <li>o Mx vertical excess (long face).</li> </ul> </li> <li>- Early jaw surgery has little inhibitory effect on further growth. (except condylectomy in patients with hemimandibular hypertrophy) → Delay surgery until growth is essentially completed</li> <li>- Assess growth status with serial ceph's.</li> <li>- Hand-wrist x-rays or vertebral stages are not accurate enough.</li> </ul>

<b>Growth deficiency</b>	<ul style="list-style-type: none"> <li>- Surgery can be considered earlier than in cases with excessive growth, but not before the adolescent growth spurt.</li> <li>- Early surgery required for: <ul style="list-style-type: none"> <li>o Congenital problems (e.g. craniosynostosis or severe hemifacial microsomia)</li> <li>o Progressive deformities caused by restriction of growth (e.g. ankylosis of the mandible)</li> </ul> </li> <li>- A severe, but stable deficiency is usually no indication for early surgery. → Exception: An extremely severe problem, in which preliminary orthodontic or surgical tx improve the patient's quality of life even though later operations will be needed.</li> <li>- Early surgery does not improve the growth prognosis (unless it relieves a specific growth restriction), nor does it produce a normal growth pattern.</li> </ul>
1. Early mandibular advancement	<ul style="list-style-type: none"> <li>- <u>Snow, 1991:</u> Many younger patients have further mn growth after early surgical advancement. Most of this growth is expressed vertically (not forward) and can prevent downward and backward rotation of the mn.</li> <li>- Early surgery before the adolescent growth spurt is not indicated for patients without progressing deformity or without severe psychosocial problems.</li> <li>- If facial growth declines to adult levels at the end of the adolescent growth spurt, there is no reason to delay mn advancement. <ul style="list-style-type: none"> <li>• Only minimal facial growth can be expected in patients with severe deficiencies during late adolescence and relapse from that cause is unlikely.</li> </ul> </li> <li>- 3<sup>rd</sup> molars: Removal 6 m before BSSO to facilitate the use of RIF.</li> <li>- <u>Proffit, 2010: Mn advancement before age 18 or later:</u> <ul style="list-style-type: none"> <li>• Some adolescent patient had downward and backward rotation of the mn or shortening of the mn length → chin prominence ↓ = Delaying advancement probably does increase the chance of long-term stability.</li> <li>• The younger patients were more satisfied with their tx than those who had surgery at an older age, even though they younger patients often recognized that their chin was no longer prominent as it was shortly after surgery.</li> </ul> </li> </ul>
2. Early maxillary advancement	<ul style="list-style-type: none"> <li>- Relatively stable, but further forward growth of the mx is unlikely.</li> <li>- Subsequent growth of the mandible is likely to result in reestablishing a class III malocclusion.</li> <li>- Surgical reposition of the entire mx may affect future growth.</li> <li>- Delay tx after the adolescent growth spurt except if tx is indicated due to psychosocial reasons.</li> <li>- <u>CLP:</u> <ul style="list-style-type: none"> <li>• Surgical procedures to correct CLP do not affect future growth of the mx.</li> <li>• Bone graft of the alveolar cleft prior to eruption of the permanent canines: → Elimination of bony defects is possible which improves the long-term prognosis of the dentition.</li> </ul> </li> </ul>

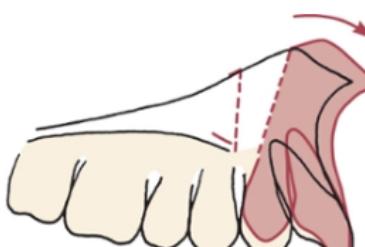
Correction of combined vertical and anteroposterior problems	
<b>Short face class II:</b> Increasing anterior face height	<ul style="list-style-type: none"> <li>- <u>Moving the mandible forward</u> <ul style="list-style-type: none"> <li>• Allows a stable increase with a-p movement.</li> <li>• Soft tissue of the lower anterior face is stretched when the chin is advanced and moved down, but the posterior soft tissues are relaxed.</li> </ul> </li> <li>- <u>Moving the maxilla down, forcing the mandible to rotate back:</u> <ul style="list-style-type: none"> <li>• Problematic: Anterior and posterior facial soft tissues are stretched.</li> </ul> </li> <li>- → The most stable type of mn advancement rotates the mn body segment as it is advanced so that the chin comes forward and downward and the mn plane angle increases.</li> </ul>
<b>Long face class II:</b> Decreasing face height	<ul style="list-style-type: none"> <li>- <u>Moving the maxilla up → mandible can rotate up and forward:</u> <ul style="list-style-type: none"> <li>• Most stable orthognathic procedure.</li> <li>• Produces a change in the postural position of the mandible: = neuromuscular adaption.</li> <li>• If the mn is still deficient after it has rotated up and forward, a mn advancement in combination with the mx procedure does not stretch the muscles and is acceptably stable.</li> </ul> </li> <li>- <u>Mandibular ramus osteotomy:</u> <ul style="list-style-type: none"> <li>• Unstable: Mandibular elevator muscles are stretched and do not adapt.</li> </ul> </li> </ul>
<b>Short face class III:</b> Increasing anterior face height	<ul style="list-style-type: none"> <li>- Mandibular ramus osteotomy (MRO).</li> <li>- + Maxillary osteotomy if downward movement of the maxilla is desired.</li> </ul>
<b>Long face class III:</b> Decreasing face height	<ul style="list-style-type: none"> <li>- Maxillary osteotomy.</li> <li>- + Mandibular ramus osteotomy if setback or further advancement of the mandible is needed.</li> </ul>

### Special points in planning orthognathic surgery

- Incision lines contract during healing:
  - Stress of the gingival attachment if they are placed in the vestibule.
  - Consider gingival grafting before genioplasty if the attached gingiva is inadequate.
- Removal of 8-8 should be done 6 m before mn ramus surgery if RIF is planned.
- Unpredictable impact of orthognathic surgery on TMD.
  - TMJ disorders are usually improved during presurgery orthodontics, but only transient.
  - If TMJ surgery along with mx/mn surgery is planned, defer it better after orthognathic surgery.  
→ The outcome of TMJ surgery is more predictable if the new joint positions and occlusal relationships have been established.
- Definitive restorative and prosthetic tx is the last step after surgery.
- Mx advancement widens the nostrils and tends to tip the nasal tip up.

### Putting surgical and orthodontic tx together: Who does what, when?

Orthodontic appliance considerations	<ul style="list-style-type: none"> <li>- Function of the orthodontic appliance:           <ul style="list-style-type: none"> <li>○ Perform tooth movements needed for the surgery preparation.</li> <li>○ Stabilization of the teeth and basal bone at the time of surgery and during healing (less important now with rigid internal fixation).</li> <li>○ Provide attachments for intermaxillary fixation.</li> <li>○ Postsurgical tooth movement while retaining the surgical correction.</li> </ul> </li> <li>- Any variation of the 18 or 22 slot edgewise is acceptable for stabilization, including self-ligating brackets if they allow a full size wire to be ligated.</li> <li>- <u>Ceramic brackets:</u> Susceptible to fracture, only exceptionally on teeth 321+123.</li> <li>- <u>Lingual appliances:</u> Some attachments on the facial surface of the teeth must be placed for temporary intermaxillary fixation.</li> <li>- <u>Clear aligners:</u> <ul style="list-style-type: none"> <li>○ Buccal attachments are necessary for surgery.</li> <li>○ 2 sets of aligners necessary: presurgical &amp; postsurgical.</li> </ul> </li> </ul>
Goals of presurgical treatment	<ul style="list-style-type: none"> <li>- (I) Place the teeth in relation to their own bone without regard to the occlusion and (II) make the arches compatible.</li> <li>- No need for preoperative tooth movements if they can be accomplished more easily and quickly during or after the operation.           <ul style="list-style-type: none"> <li>○ Extrusion is in general more easily to perform postsurgically.</li> <li>○ Intrusion must be accomplished presurgically or handled surgically.</li> </ul> </li> <li>- Presurgical phase should not require &gt; 1 y. Exception: Delay caused by waiting for growth to be completed.</li> </ul>
Steps in orthodontics for preparation of surgery	<ul style="list-style-type: none"> <li>- <u>Leveling the mandibular arch:</u> The desired final face height decides about intrusion or extrusion to level an accentuated curve of Spee.           <ul style="list-style-type: none"> <li>• Intrusion:               <ul style="list-style-type: none"> <li>○ Correction presurgical or during surgery with a subapical osteotomy to depress the lower incisor segment.</li> <li>○ Segmented arch approach is indicated.</li> </ul> </li> <li>• Extrusion:               <ul style="list-style-type: none"> <li>○ More easily performed postsurgically, except the lower face height is not allowed to increase</li> <li>○ Levelling after surgery occurs rapidly because the teeth are not in contact.</li> <li>○ Deep bite - short face patients: Alignment is better performed after surgery.</li> </ul> </li> </ul> </li> <li>- <u>Leveling the maxillary arch:</u> <ul style="list-style-type: none"> <li>• Severe vertical discrepancies within the mx arch are an indication for multiple segment surgery:               <ul style="list-style-type: none"> <li>○ The upper arch should not be levelled conventionally.</li> <li>○ Avoid extrusion of the anterior teeth. → A small orthodontic relapse could create a postsurgical open bite.</li> </ul> </li> </ul> </li> </ul>

Establishment of the incisor position and space closure	<ul style="list-style-type: none"> <li>- <b>Mandible:</b> The anteroposterior position of the incisors determines where the mandible will be placed relatively to the maxilla at surgery.</li> <li>- <b>Maxilla:</b> If several surgical segments are planned, the axial inclination of the upper incisors and canines should be established presurgically so that major rotation of the anterior segments at surgery can be avoided. → Intraoperative rotation of the anterior segment to maintain the vertical position of the mx incisors, while their inclination is changed, tends to elevate the canine off the occlusal plane and diverge the roots at the osteotomy site.</li> </ul>  <ul style="list-style-type: none"> <li>- If the extraction site is the location of an osteotomy cut, don't close it completely. (leave room for interdental cuts)</li> </ul>
<b>Surgery first without any presurgical orthodontics</b>	<ul style="list-style-type: none"> <li>- The approach was evaluated and discarded in the 1970s, but reintroduced recently.</li> <li>- Pros: <ul style="list-style-type: none"> <li>o Faster tx because segmental osteotomies could be used to accomplish much of the presurgical tooth movement.</li> <li>o Teeth close to the osteotomy sites might move more rapidly. (regional acceleration of bone remodeling)</li> <li>o Patients are happy because their major problem would be addressed first and tx is shorter.</li> </ul> </li> <li>- Contras: <ul style="list-style-type: none"> <li>o The surgical procedures and postsurgical orthodontics are more difficult.</li> <li>o Limitations in anteroposterior changes because of the lack of presurgical decompensation of the incisors' position.</li> <li>o Longer postsurgery orthodontics makes patients unhappy with surgical tx.</li> </ul> </li> <li>- No good evidence for the advantages → Apply with care.</li> <li>- <i>Hernandez-Alfaro, 2014:</i> Patients with severely crowded teeth or deep bite are not good candidates for surgery first.</li> </ul>

**TABLE 20.1** Sequence of Surgical–Orthodontic Treatment

Consensus Sequence	Surgery First
Orthodontic plan, preliminary surgical plan	3-D imaging (?), surgical plan, postsurgical orthodontic plan, splints
Presurgical orthodontics	Orthodontic appliance only, no surgical stabilizing archwire
Final surgical plan	
Orthodontic surgical procedure with final, intermediate (?) splints	Orthognathic surgery, dentoalveolar surgery, corticotomy (?), intermediate and final splints, temporary anchorage devices (TADs) for postsurgical orthodontics
Minimal postsurgical orthodontics, 3–6 months	Extensive (bone screws or miniplates) for postsurgical orthodontics

Stabilizing arch wires	<ul style="list-style-type: none"> <li>- Should be in place 4 weeks before surgery so that they are passive when the impressions for the splint are taken.</li> <li>- Full dimension wires: 22-slot: 21x25 TMA or ss.</li> <li>- Should contain hooks to tie the jaws together.</li> <li>- Surgery first approach: <ul style="list-style-type: none"> <li>• No archwires at the operation, but an orthodontic appliance has been placed so that the archwires or archwire segments can be placed at the operation or soon afterwards.</li> <li>• Orthodontic tx begins during the 1<sup>st</sup> week postsurgical usually.</li> </ul> </li> </ul>
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Patient management at operation and postoperative care	
Final surgical planning	<ul style="list-style-type: none"> <li>- Presurgical records: <ul style="list-style-type: none"> <li>• OPG, lateral cephalometric, dental casts mounted in a semiadjustable articulator.</li> <li>• Periapical x-rays of osteotomy sites.</li> <li>• CBCT indicated if a jaw asymmetry has to be corrected.</li> </ul> </li> <li>- Surgical movements and resulting soft tissue changes are evaluated using a cephalometric or CBCT.</li> <li>- Surgical models are duplicated → virtual or actual model surgery → fabrication of the dental splints.</li> </ul>
Splints and stabilization	<ul style="list-style-type: none"> <li>- Interocclusal wafer splint made from the casts repositioned by the model surgery.</li> <li>- As thin as consistent with adequate strength: Never more than 2 mm thick at the thinnest point.</li> <li>- When the lower arch has not been leveled presurgically, some teeth can contact through the splint.</li> <li>- The splint stays in place during initial healing (typically 2 weeks).</li> <li>- Don't remove the splint immediately after the use in the operation room.</li> <li>- Splint should allow good access to the teeth for oral hygiene and permit lateral movements during jaw function.</li> <li>- Replace the stabilizing wires with lighter and more flexible archwires at the same time as the splint is removed. Patient is positioned in RK und may has only a few contacts → Risk of a slide to find a more convenient bite which can make orthodontics more difficult and stress surgery sites.</li> </ul>
Postsurgical care	<ul style="list-style-type: none"> <li>- Time at the hospital: <ul style="list-style-type: none"> <li>• Lower border osteotomy: No overnight stay.</li> <li>• Maxillary osteotomy: No overnight stay.</li> <li>• Bimaxillary surgery: 1 night stay. (can be at a surgical center, not necessarily at a hospital)</li> </ul> </li> <li>- Normally little use of pain medication: <ul style="list-style-type: none"> <li>• Operations involving the mandibular ramus require about the same amount of pain medication as extraction of impacted wisdom teeth.</li> <li>• Mx procedures are tolerated better than that.</li> </ul> </li> <li>- Early return to jaw movements eliminates the discomfort.</li> <li>- <u>Diet:</u> <ul style="list-style-type: none"> <li>• <u>1<sup>st</sup> week soft diet:</u> Milkshakes, potatoes, scrambled eggs...</li> <li>• <u>2-3<sup>rd</sup> w:</u> Soft food that requires some chewing: pasta, meat in pieces...</li> <li>• <u>6-8<sup>th</sup> w:</u> Back to the normal diet.</li> <li>• Degree of discomfort can be used as guide to the progression rate.</li> </ul> </li> <li>- <u>Physical therapy</u> <ul style="list-style-type: none"> <li>• Start as soon as the postsurgical intracapsular joint edema is resolved.</li> <li>• <u>1-2<sup>nd</sup> w:</u> 3 x 10-15 min sessions of opening and closure exercises + lateral movements with closing into the splint.</li> <li>• <u>3-8<sup>th</sup> w:</u> Range of motion should be increased.</li> <li>• <u>8<sup>th</sup> w postop:</u> Normal function should be achieved.</li> </ul> </li> </ul>
Postsurgical orthodontics	<ul style="list-style-type: none"> <li>- Start when the splint is removed and the working wires are replaced by light wires. <ul style="list-style-type: none"> <li>• → A flexible rectangular wire in the upper arch to maintain torque control of the maxillary incisors often is a good choice with a round wire in the lower jaw: 22 slot: mx 21x25 M-NiT, mn 16 ss. The opposite is possible if more mx tooth movement than mn tooth movement is needed.</li> <li>• Light vertical elastics are needed initially to override proprioceptive impulses from the teeth that otherwise would cause the patient to seek a new position of maximum intercuspal occlusion.</li> <li>• Removing the splint without allowing the teeth to settle into better interdigitation can result in the patient adopting an undesirable convenience bite. → Orthodontics can be complicated and risk for stress to the surgical sites.</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>- Use light vertical elastics to close the bite with the working wires until the occlusion is settled.           <ul style="list-style-type: none"> <li>• 1-4<sup>th</sup> w postsurgery: 4/4 incl. eating</li> <li>• 4-8<sup>th</sup> w postsurgery: 4/4 without eating</li> <li>• 8-12<sup>th</sup> w postsurgery: 2/4</li> </ul> </li> <li>- Postsurgical orthodontics should not take &gt;6 m: → Patients are intolerant for longer tx afterwards.</li> <li>- <u>Retention:</u> <ul style="list-style-type: none"> <li>• Same retention like for adult patients with orthodontic tx.</li> <li>• Surgical maxilla expansion requires minimum 6 months fulltime retention. If a transpalatal bar was placed, it should not be removed during the first postsurgical year.</li> </ul> </li> </ul>
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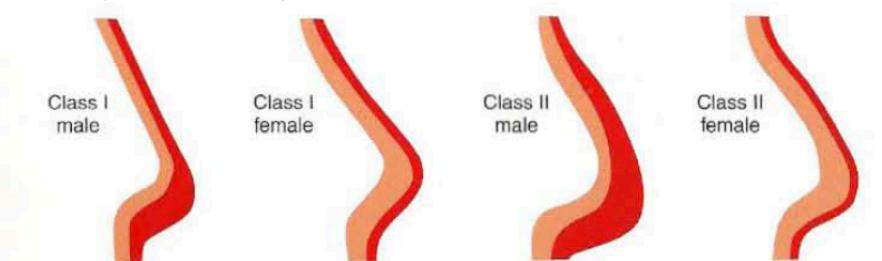
### Discussion with Dr. Gkantidis 09.05.2017

- Body dysmorphic disorder:  
Psychological disorder. Whatever you do to the patients, they will ask for more.
  - High palatal vault → easier to expand → prefer Le Fort 1 + 3-piece to SARPE.
  - Low risk for hemorrhage after SARPE or Le Fort 1.
  - Wait 3 weeks to perform sport post-operative (12 weeks for contact sport).
  - Antibiotics for 7 days perioperative. After that, infections occur rarely.
  - 3-6w 100% work incapability.
- SARPE vs. 3-Piece
- |  |  |   |
|--|--|---|
|  | <b>SARME</b><br>- Reduced morbility (?)<br>- Reduces need for extractions<br>- Less operator-sensitive | <b>LF I - 3</b><br>- More precise positioning segments<br>- Allows other movements maxilla      |
|  | - Reduced control position segments<br>- Extra-surgery   | - Possible need for extractions<br>- Increased morbility (?)<br>- Limit to expansion (c.a. 7mm) |

- The aging face:

Männer	Frauen
Profil wird gerader	Profil wird nicht gerader
Lippen werden retrusiver	Lippen werden nicht retrusiver
Nase wird grösser in allen Dimensionen	Nase wird auch grösser in allen Dimensionen aber weniger ausgeprägt
Kinn wird prominenter	Pogonion wird reduziert

- Shape of the Nose: (Chaconas, 1969)



**Fig. 4-7** Patterns of nasal growth, based on cephalometric data from the Bolton growth study (i.e., longitudinal data for white children of northern European descent). Note that both males and females show more growth in vertical height than anteroposterior projection of the nose, but downward growth is greater in males. Boys have an adolescent growth spurt in nose length, whereas girls often do not. A dorsal hump in the nose often develops when Class II malocclusion is present and is more pronounced in boys. (From Chaconas SJ: A statistical evaluation of nasal growth, *Am J Orthod* 56:403-414, 1969.)

- Nose:
  - o Tip follows surgical movement 20%
  - o Base follow surgical movement 50%

→ Mx advancement or set up widens the nose.
- Genioplasty:
  - o Maximum augmentation = 6 mm
  - o Maximum reduction is limited by the length of the roots of the teeth.

- Mx down positioning
  - o Stability is problematic due to changes within the first few postsurgical weeks before bone healing is complete, as occlusal force tends to push it upwards.
  - o Approaches to maintain the position:
    - Heavy rigid fixation (more than screws and plates).
    - Rigid graft.
    - Simultaneous mn surgery to decrease the occlusal force.
- *Triaca*:
  - OSAS: Minimum 10 mm mn advancement required to achieve a positive effect on the respiration.
  - Distraction is recommended if mn advancement > 8 mm.
  - Botox application before and after BSSO can reduce relapse tendency from 10-50% to 5%.
- Fewer patients exhibit long-term changes in the dental occlusion than skeletal changes, because adaptive changes often occur in the dentition when skeletal changes occur.

### Soft Tissue/Hard Tissue Ratios, Manual Prediction

Treatment	Soft Tissue Change	Notes
Anteroposterior movement of incisors: maxillary or mandibular, forward or back, surgical or orthodontic	60% to 70% of incisor movement	1, 2
Vertical movement of incisors	Minimal unless jaw rotates	3, 4, 5
Mandibular advancement	Soft tissue: chin 1:1 with bone, lower lip; 60% to 70% with incisor	6
Maxillary advancement	Nose: slight elevation of tip Base of upper lip: 20% of point A Upper lip: 60% of incisor protraction, shortens 1 to 2 mm	7, 8
Mandibular setback	Chin: 1:1 Lip: 60%	5
Maxillary setback	Nose: no effect Base of upper lip: 20% of point A Upper lip: 60% of incisor Advancement lower lip: variable, may move back	3
Mandibular setback plus maxillary advancement	Changes similar to a combination of the two procedures separately	
Maxillary superior repositioning	Nose: usually no effect Upper lip: shortens 1 to 2 mm Lower lip: rotates 1:1 with mandible	7
Mandibular advancement plus maxillary superior repositioning	Chin: 1:1 Lower lip: 70% of incisor Upper lip: shortens 1 to 2 mm 80% of any incisor advancement Nose: slight elevation of tip	9
Mandibular inferior border repositioning	Soft tissue forward: 60% to 70% bone Chin: Up—1:1 with bone Back—50% bone Laterally—60% bone Down—?	

From Proffit, White<sup>1</sup>.

1. Little difference with surgery or orthodontics.
2. If both upper and lower incisors are retracted (bimaxillary protrusion), lip movement stops when lips come into contact.
3. Lip shortens 1 to 2 mm with vestibular incision (more if surgical technique is poor).
4. Lip rotates with mandible 1:1.
5. If face height increases, lip may uncurl and lengthen.
6. If lip uncurls, it will go forward less.
7. Nose change is usually temporary.
8. Less soft tissue change occurs after cleft lip repair.
9. Data from Jensen AC, Sinclair PM, Wolford LM: Soft tissue changes associated with double jaw surgery, *Am J Orthod Dentofac Orthop* 101:266-275, 1992.

## Presurgical Versus Postsurgical Orthodontics

Procedure	Comment
<b>NECESSARY BEFORE SURGERY</b>	
Alignment	Primarily by tipping: flexible round wire (16 mil austenitic NiTi best)
Intrusion (leveling)	Segmented arch technique required; stabilizing lingual arches needed; Burstone depressing arch (17 × 25 TMA or steel) suggested
Arch compatibility	Be careful regarding: Second molars' vertical position (Don't elongate upper second molars!) Canine widths
<b>BEFORE AND/OR AFTER SURGERY</b>	
Posterior crossbite correction	No orthodontic expansion before surgery in a patient who will have surgical expansion OK to leave up to half-cusp crossbite for correction after surgery
Extrusion (leveling)	Easier and more efficient after surgery; partial leveling with continuous archwires can be done before surgery
<b>NECESSARY AFTER SURGERY</b>	
Extrusion (settling, leveling)	Should complete in 4 to 6 months
Root paralleling at osteotomy sites	
Detailed tooth positioning	