

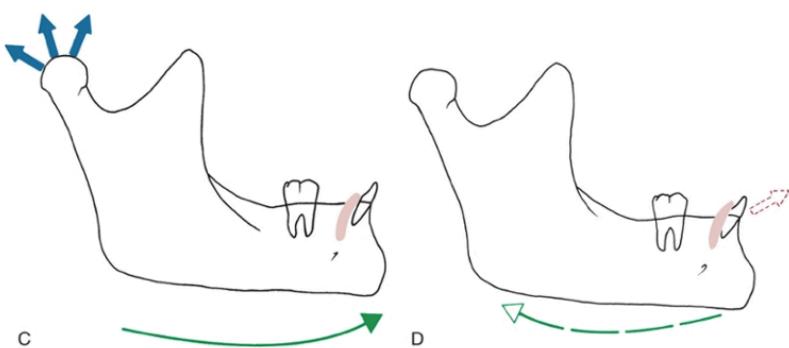
Fixed cl.II correctors	
Fixed cl.II correctors	<ul style="list-style-type: none"> - Most fixed functionals appliances tip teeth and have dentoalveolar effects when used in adolescents. The amount of tipping depends on which anterior and posterior teeth are included in the anchorage units through supplementary bonding or banding. - Protrusive effect on the mn dentition, because the appliance contacts the lower incisors and some of the protraction force is transmitted to them. → Can be reduced by skeletal anchorage (which does not affect skeletal changes). - Low prevalence of TMJ dysfunction which is similar to removable appliances. (poorly documented)
1. Herbst appliance	<ul style="list-style-type: none"> - Created by <i>Herbst</i> in the early 1900s and reported on it in 1930. - Rediscovered and popularized by <i>Pancherz</i> 1970. - Dental and skeletal effect. - Use in the early permanent dentition (not in the mixed dentition). - Can produce maxillary posterior dental intrusion: → Ideally used in patients with normal or slightly long anterior face height.
2. MARA	<ul style="list-style-type: none"> - Developed by <i>Toll and Eckhart</i> in the 1990. - Upper elbow interferes with the lower fixed arm → patient must advance the mandible in order to close the mouth. - HG effect + effect on the mandible (less than a Herbst appliance). - Preferred by patients in comparison to Herbst.
3. Forsus 4. Cemented Twin-Block	<ul style="list-style-type: none"> - Upper distal and intrusive moments + lower mesial dental movements. 
Literature	<ul style="list-style-type: none"> - <i>Tarvade, 2014. Fixed Twin-Block vs. Forsus:</i> <ul style="list-style-type: none"> ○ More positive mn changes for Twin-Block. ○ Forsus: More vertical skeletal and dental changes. - <i>Guintini, 2015. Fixed Twin-Block vs. Forsus:</i> <ul style="list-style-type: none"> ○ Forsus: More positive mn change, mx restriction ↑, mn incisor proclination ↑. - <i>Siara-Old, 2012. MARA-appliance vs. Twin-Block:</i> <ul style="list-style-type: none"> ○ MARA: mx restriction ↑, mn advancement ↓ in short term.
Class II elastics	<ul style="list-style-type: none"> - Effects: Mx dental retraction, mn dental protraction. - More mesial displacement of the mn teeth than stimulation of mandibular growth. → Cave: Protruding incisors tend to upright after tx → crowding. - Minimum 250 gm force needed to shift one dental arch relative to the other with a square wire. Less force is needed with a higher, rounder wire in the mandible.

Components of removable and fixed cl.II appliances

- The appliance design has a great influence on the effects to the teeth.
- Active components:
 - o Patient has to voluntarily move the mn by use of the musculature to avoid an interference.
→ Produces external pressure.
 - o Activator, bionator, Twin-Block, MARA
- Passive components:
 - o Only a restricted path of movement or closure is allowed.
 - o Herbst, Forsus.

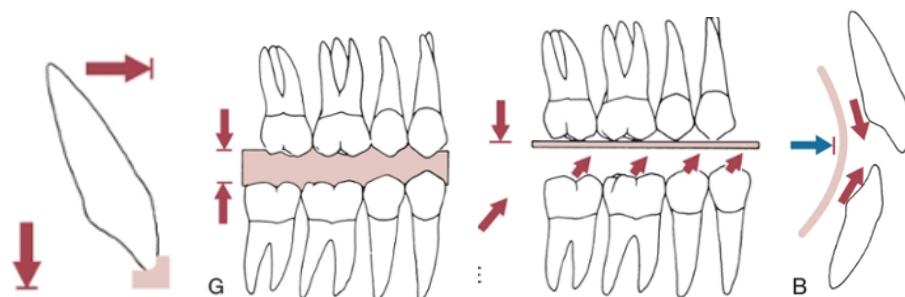
1. To advance the mandible

- **Flanges:**
 - o Against the mn alveolar mucosa /
Below the mn molars /
Lingual pads contacting the tissue behind the lower incisors (Fränkel)
 - o Stimulus to posture the mandible to a more anterior position.
- **Ramps** supported by teeth (Twin-Block)
- **Elbows (MARA)**
- Cave: Compensatory movement of the molars and incisors from forward posturing the mn! → Try to minimize them by adapting how and where the forces are applied.



2. Vertical control components

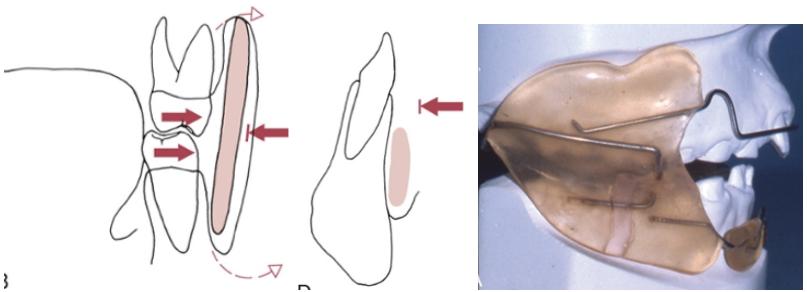
- Acrylic / wires are placed in contact with the teeth → the vertical dimension is opened → stretch of tissues exerts an intrusive force on the teeth.
Normal eruption is impeded, but no intrusion occurs (probably because the force is not constant).
- Occlusal or incisal stops incl. **bite blocks**:
 - o Incisal stop can extent to the facial surface and control the anteroposterior incisor position.



- **Lingual shields (B)**
 - o Prevents the tongue to be placed between the teeth → enhancement of tooth eruption.
 - o Cave: Speaking is difficult.

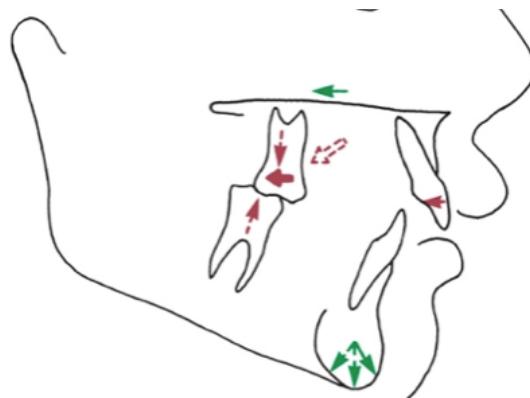
3. Stabilizing components

- **Clasps:**
 - o Help at the beginning to adapt to the appliance.
 - o Can be removed or deactivated when the patient has learnt to use the appliance.
- **Labial bow:**
 - o Use recommended in almost all instances to put the appliance in proper position, not to tip the upper incisors lingually.

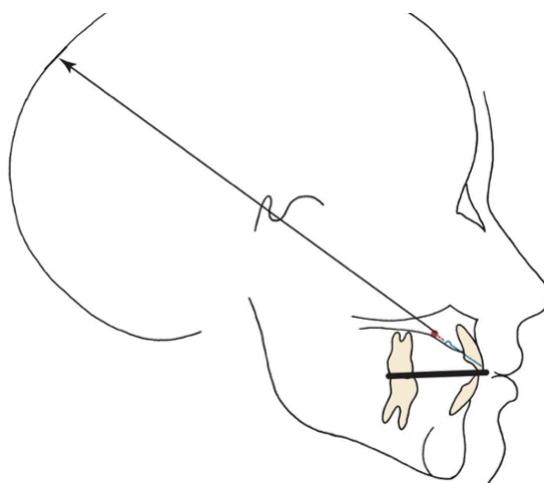
	<ul style="list-style-type: none"> ○ → Bow does not touch the incisors when the appliance is put in place, but nevertheless often contacts them when the appliance moves or is displaced. ○ → Extreme lingual tipping of the upper incisors during functional appliance tx usually reflects a failure of the child to keep the mandible positioned forward while wearing the appliance.
4. Passive components	<ul style="list-style-type: none"> - Plastic buccal shields and lips pads: (Fränkel) <ul style="list-style-type: none"> ○ Hold the soft tissues away from the teeth. <ul style="list-style-type: none"> ■ Disrupt the tongue-lip-equilibrium. ■ Facial movement of the teeth, arch expansion, increase in arch length. ■ Environment is likely to revert to what it was previously when the appliance is removed. ○ Force of the lip to stretch helps to improve lip seal. ○ Potential for soft tissue irritations → can reduce compliance. ○ Shields extended to the depth of the vestibule have potential for periosteal stretching which facilitates bone deposition.  <p>The diagram shows a dental model with a vertical shield placed between the upper and lower teeth. Red arrows indicate forces being applied to the shield and the surrounding soft tissue. The photograph shows a dental patient wearing a clear plastic orthodontic appliance with similar buccal shields in place.</p>
5. Active expansion / alignment components	<ul style="list-style-type: none"> - Correction of the occlusal relationship by actively moving teeth is not the original goal of functional appliance. - Springs / screws: <ul style="list-style-type: none"> ○ Produce only tipping, no precise tooth movements are possible. → Tipping is more susceptible to relapse. - Tooth movement ↑ → potential to achieve skeletal changes ↓

Treatment procedures with functional appliances and clinical management	
Pretreatment alignment	<ul style="list-style-type: none"> - Necessary for cl.II:2 or crowded upper incisors. - More efficiently performed with a partial fixed appliance than a removable appliance. - Several months of retentions necessary after repositioning.
Impression and working bite for functional appliances	<ul style="list-style-type: none"> - Don't overextend the impression so that tissues are displaced if buccal shields or lip pads are planned. - For cemented, bonded or partial fixed appliances only the impression of the teeth is important, but not the vestibule. - Small and big advancements are similar effective, but smaller advancements are more comfortable. - Working bite: <ul style="list-style-type: none"> ○ Advance the mandible to move the condyles out of the fossa and establish the desired vertical opening. ○ Symmetric advancement if no asymmetry has to be corrected. ○ 4-6 mm advancement. ○ <u>Normal face height patients:</u> <ul style="list-style-type: none"> ▪ 3-4 mm vertical opening. ▪ Interocclusal stops or facets to guide eruption usually require 4-5 mm of posterior separation to be effective. ○ <u>Long-face patient:</u> <ul style="list-style-type: none"> ▪ Vertical opening 2-3 mm past the resting vertical dimension = 5-6 mm total opening in the molar region. → The soft tissue stretch against the bite blocks will produce a force opposing eruption of lower posterior teeth. ○ Avoid edge-to-edge incisor relationship. ○ Avoid interferences from retromolar soft tissues.
Clinical management of removable functional appliances	<ul style="list-style-type: none"> - Begin: Wear the appliance only a short timer per day and then increase the time gradually over the first few weeks up to 12h/d. - Wear the appliance 8 p.m. - 1 a.m.: <ul style="list-style-type: none"> → Time period when growth and tooth eruption are occurring. - If a sore spot develops, wear the appliance 2 days more for some hours. <ul style="list-style-type: none"> → Source of the sore can be accurately determined. - Give a chart: = Data record & reinforcement to wear the appliance. Cave: Time reported by patients and actual compliance often do not coincide. - Records + minimum a laterals ceph after 8-10 m to reevaluate the progress. Because initial advancement is only 4-6 mm, many children need a new / modified appliance.
Clinical management of fixed functional appliances	<ul style="list-style-type: none"> - Fixed functional appliances: <ul style="list-style-type: none"> • Often create initially problems with the forward position of the mn. • Accommodation increases rapidly after several days. • Sore teeth for an extended moment indicate poor cooperation: The appliance should only remind, but not force the mandible to be put forward without heavy force. • Avoid hard & sticky food, large mouthfuls and exaggerated mn movements. • 1-2 mm relapse must be anticipated. • Records after the appliance is removed. • Removable retention device in case the patient is still in the mixed dentition after removal of the appliance. - Herbst: <ul style="list-style-type: none"> ○ 8-12 m in situ - Forsus: <ul style="list-style-type: none"> ○ Arches should be coordinated sagittal and transversal to avoid interferences. ○ 19x25 mil SS wire secured with wire tied under the archwire or a chinch-back to consolidate the arch length and avoid space opening. ○ Ideal activation: 2 mm space between the completely compressed spring and the pushrod stop when the patient is in CR. ○ The appliance can run form 6+6 to the distal aspect of 3-3 or 4-4 (vertical, intrusive component ↑). ○ May apply lingual torque to avoid incisor proclination. ○ 6-8 m in situ followed by 4-6 w with the spring in a passive state.
Clinical management of extraoral force: HG	<ul style="list-style-type: none"> - Effect: <ul style="list-style-type: none"> • Decrease of the amount of forward and/or downward growth of the maxilla by changing the pattern of apposition of bone at the sutures.

- Evidence for increased mn growth during HG tx (*Keeling, 1998*).
- Clinic:
 - Weartime = 10-12h/d, best time period = evening.
 - **350-450 g/side** depending if skeletal or dental effects are desired.
 - Lighter forces: May produce only dental effects.
 - Forces > 1000 gm: Unnecessary traumatic to the teeth and supporting structures.
- Factors influencing the selection of the HG:
 - Anchorage location
 - Determine the vertical force component.
 - → The more signs of an excessive vertical growth pattern exist, the higher the direction of the pull should be chosen.
 - *Haralabakis, 2004*: Cervical HG does not always aggravate vertical problems, esp. when the vertical mn growth is good.
 - Attachment of the HG to the teeth:
 - Facebow inserted into HG tubes on bands 6+6
 - Mx splint
 - Functional appliance
 - Bodily movement vs. tipping required?:
The length and position of the outer bow and the anchorage form define the vector of the force and its relation to the center of resistance 6+6.
→ Orientate the vector of force in relation to the **center of resistance of the molar (midroot region)** to adapt the effect.
- Avoid distal tipping and elongation of the molars if a change of the skeletal relationship is desired. Downward mx movement or mx and mn molar eruption can reduce or totally negate forward growth of the mn.
(this would project mn growth more vertically)
→ Highpull HG is usually preferred.

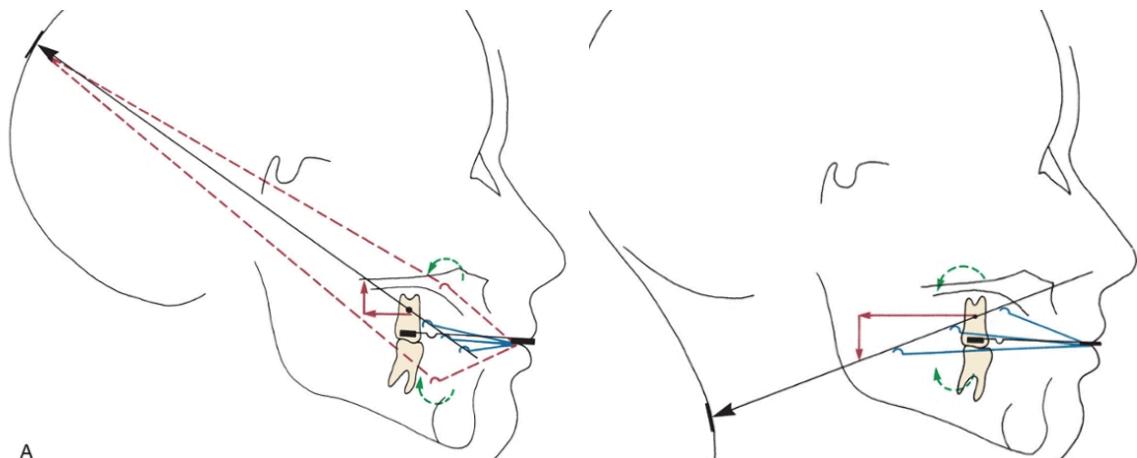


- **Center of resistance of the maxilla = above premolar apexes:**
 - Mx rotation is possible, if the line of force does not run through the center of resistance.
 - High pull HG directs the force closer through the center of resistance.
 - HG to a mx splint covering all teeth makes it easier to control the rotation of the mx.
- With all the teeth splinted, the maxilla can be considered as an unit and the line of force related to the center of maxilla.
→ Distal tipping of the mx incisors is likely to occur also when a skeletal effect is the goal, because the distal component of the force is delivered to these teeth.



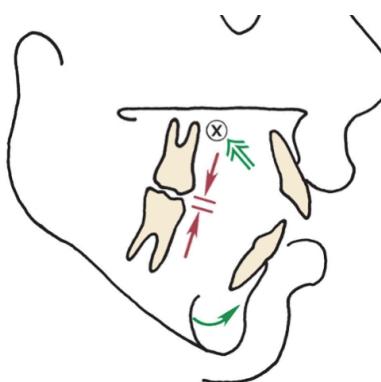
- HG adaption:

- Expand the inner bow 2 mm to prevent CB during Cl.II correction.
(inserted in one tube, it should rest just outside the other tube)
- No contact of the inner bow with the teeth (3-4 mm distance).
- Inner bow ends flush with the end of the tube.
- Junction of the inner and outer bows rests passively between the lips.
- Outer bow rests several mm away from the soft tissue of the cheek.
- Determine the proper length of the outer bow by simulating the direction of force with the fingers from anterior to posterior.
→ If the bow does not move = force through the center of resistance.
 - A longer outer bow bent up or a shorter outer bow bend down could produce the same line of force.
 - The outer facebow of a cervical HG is nearly always longer than the outer bow used with a highpull HG.
- Choose a spring mechanism, no elastic bands for consistent forces.



- Php HG: A longer outer bow bent up or a shorter bent down could produce the same line of force.
- Plp HG: A longer outer bow bent down or a shorter bent up could produce the same line of force. The outer bow of a cervical HG is nearly always longer than the outer bow used with php HG.

Combined vertical and anteroposterior problems	
Vertical problems	<ul style="list-style-type: none"> - Skeletal vertical problems are connected with excessive or deficient dental eruption and it can be difficult to determine the extent to which skeletal disproportions vs. tooth eruption deviations are involved. - Consider: The mn grows downward from the mx and the teeth must erupt to remain in contact. → Patients with deficient vertical growth also have deficient tooth eruption and vice versa. - The vertical position of the mx posterior teeth determines the vertical position of the mn: Excessive eruption → mn rotates downward and backward.
Short face / deep bite	
Characteristics of short face individuals	<ul style="list-style-type: none"> - Skeletal vertical deficiency occurs almost always in conjunction with an anterior deep bite and some mn deficiency / often Cl.II:2. - The reduced face height is often accompanied by everted and prominent lips that would be normal with normal face height. - Characteristics: <ul style="list-style-type: none"> o Children can be determined at an early age. o Low mn plane angle (skeletal deep bite). o Long mn ramus. (Note: does not make sense, if a vertical deficit exists) o Growth is expressed in an anterior direction with a tendency towards upward and forward rotation of the mn.
Tx goals	<ul style="list-style-type: none"> - Increase the eruption of the posterior teeth. - Influence the mn to rotate downward without decreasing chin prominence too much.
Appliances	<ul style="list-style-type: none"> - <u>Tx options if cl.II:</u> <ul style="list-style-type: none"> o Cervical HG → Extrusive tendency for the mx and mn teeth. Cave: Risk to rotate the occlusal plane posterior down → cl.II ↑. - <u>Tx options if cl.I:</u> <ul style="list-style-type: none"> o Mn teeth are allowed to erupt, eruption of mx teeth is inhibited. → Functional appliance (not fixed in the mixed dentition short face tx) that inhibits eruption of mx teeth and allow free eruptions of mb posterior teeth. o → Eruption is faster in some patients than others. Affected by the resting mn posture, the freeway space the appliance wear-time. - Cave: Many short face patients also have a cl.II occlusion. → Rotation of the occlusal plane downward in the front makes it easier to achieve a cl.I occlusion. Greater eruption of mx teeth, rotates however the occlusal plan posterior down = accentuation the cl.II occlusion. → In severe cl.II patients, may correct first the anteroposterior relation before you begin grinding the appliance for molar eruption.

Long face / open bite	
<ul style="list-style-type: none"> - Excessive mx growth in children with a cl.II malocclusion has more of a vertical than an anteroposterior component: Mx moves down → downward + backward rotation of the mn = mn growth is not expressed in anterior direction - In many preadolescence patients, open bite tendency reduces without tx. In others, the open bite tendency persists. - Vertical facial growth continues into the post adolescent years: → Long active retention necessary. → Tx approach only for minor-to-moderate problems and plan the intervention towards the end of growth period. 	
Tx goal:	<ul style="list-style-type: none"> - Control the posterior mx vertical growth, so that the mn can rotate in an upward and forward direction. - Control all tooth eruptions if there is adequate mn vertical ramus growth. 
Tx options:	<ul style="list-style-type: none"> - Tx options in order of increasing clinical effectiveness: <ol style="list-style-type: none"> 1. <u>High-Pull HG to the molars:</u> <ul style="list-style-type: none"> ○ Control the vertical position of the maxilla and inhibit the eruption of the maxillary posterior teeth. ○ Cave: Does not control the eruption of the lower molars which can outstrip changes made by controlling the upper molars with a HG. 2. <u>High-Pull HG to a maxillary splint</u> <ul style="list-style-type: none"> ○ Vertical force directed against all mx posterior teeth or extended forward to include also the anterior teeth. ○ Useful for children with excessive vertical development of the entire mx arch and too much exposure of the mx incisors from beneath the lips. ○ Cave: Mn posterior teeth can erupt freely → may no direction of growth, nor favorable upward & forward rotation of the mandible. 3. <u>Functional appliance with bite blocks</u> <ul style="list-style-type: none"> ○ Slight HG-effect. The eruption of the posterior teeth and the vertical descent of the maxilla are inhibited, with / without anterior positioning of the mandible. ○ Open the bite past the normal resting vertical dimension: (5-6 total opening in the molar region) → Stretch of the soft tissues → vertical intrusive force on the posterior teeth. ○ Anterior teeth can erupt in children with an anterior open bite. ○ Mn growth is projected anteriorly. ○ Cave: <ul style="list-style-type: none"> ○ Retention is necessary during later tx. (bone screws, bite plates) ○ Later fixed appliances do not well control eruption and are in many actions extrusive. 4. <u>High pull HG to a functional appliance with bite blocks</u> <ul style="list-style-type: none"> ○ Addition of an HG provides little if any more vertical skeletal and dental control and only a modest anterior-posterior maximum

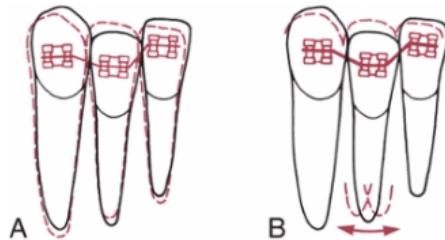
	<p>skeletal impact → Benefit should be weighed against a simpler functional appliance without HG.</p> <ul style="list-style-type: none">○ <i>Freeman, 2007:</i> The skeletal impact of a HG-functional appliance stage (when treated later with fixed appliances) is so little, that it can no longer be recommended. <p>5. <u>Intrusion of posterior teeth with skeletal anchorage / mx segmental osteotomy</u></p>
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Facial asymmetry in children	
Epidemiology of facial asymmetries	<ul style="list-style-type: none"> - Severe asymmetric development which causes problems is rare: 0.5% US population. - Asymmetric problems involving only the mx are rare and most likely due to trauma. - Asymmetries involving only the nose are more common and are often also due to trauma. - The mn is involved in 85-90% of the facial asymmetry cases, because of growth problems → secondary effect on the mx → mx & mn are both likely to be involved if an asymmetry develops.
Asymmetric mandibular deficiency	<ul style="list-style-type: none"> - Possible causes for an asymmetry: <ul style="list-style-type: none"> o Congenital anomalies (hemimandibular microsomia): <ul style="list-style-type: none"> o Likely to be noticed at birth. o Involves also the ear. o Growth modification is only effective for the least affected patients. o Fracture of the condylar process (often not reported): <ul style="list-style-type: none"> o The later the asymmetries arise: <ul style="list-style-type: none"> → Likelihood that origin is a fracture ↑. o Most of the time not diagnosed when they happen.
- Treatment of condylus fractures	<ul style="list-style-type: none"> - Maintain the function: Translation is necessary for regeneration. <ul style="list-style-type: none"> → Stretch of the associated soft tissues in the short term. → Allowance of normal growth in the long term. → Control not only the maximum mouth opening. - Most fractures in preadolescent children can be treated without surgical manipulation of the segments and little immobilization of the jaws. The bony segments are self-retentive. Rapid healing process. - Tx approach: <ol style="list-style-type: none"> 1. Short fixation time (IO intermaxillary elastics). Avoid open reduction of the fracture (risk for scarring). 2. Rapid return to function. 3. Functional appliance during post-injury period to minimize any growth restriction. - The extension to which the affected side can translate establishes the prognosis for growth modifications in case of an asymmetry. - Hybrid functional appliances can be useful to achieve more growth on the fracture side.
- Surgical therapy of mn asymmetric deficiencies	<ul style="list-style-type: none"> - Surgical interventions prior to adolescence are indicated only to create an environment in which growth is possible. <ul style="list-style-type: none"> → Indicated only when abnormal growth is progressively making a problem worse (e.g. ankylosis). - Functional hybrid appliances are needed after the surgical intervention has made condylar translation possible to correct the primary growth problem, decompensate the dental arches vertically and guide function.
Asymmetric mandibular excess	<ul style="list-style-type: none"> - Excessive mn growth on one side = hemimandibular hypertrophy. - Females more affected than males. - Progressive deformity. - Growth modification to stop excessive growth is not possible. - Early surgery is maybe necessary.
Discussion 21.2.2017	
<ul style="list-style-type: none"> - Start of class II functional therapy: Shortly before the growth spurt and with the growth spurt. - Define the growth spurt. <ul style="list-style-type: none"> • Gender • Age • Secondary sexual characteristics → Start tx boys: About at 11 y. → Start tx girls: About at 10.5 y. 6 m before boys. - Twin Block: Better compliance than with an activator because patients can speak. - HG: 8 h necessary for retention. More (minimum 12 h) necessary for active tx. 	

Proffit Chapter 15:

Comprehensive Treatment in Adolescents: Alignment and Vertical Problems

<ul style="list-style-type: none"> - Comprehensive tx: = Effort to make the patient's occlusion as ideal as possible, repositioning all or nearly all the teeth in the process. 	
Class I crowding / protrusion	
Alignment	<ul style="list-style-type: none"> - Components of the alignment: <ul style="list-style-type: none"> o Bring malpositioned teeth into the arch. o Specify and correct: <ul style="list-style-type: none"> ▪ Anterior-posterior position of the incisors ▪ Posterior width of the dental arches ▪ Form of the dental arches: Preserve the patient's original arch form for a more stable result. o Define if and how and curve of Spee will be leveled. - The final tooth position dictates the mechanotherapy necessary during alignment and leveling. - Alignment requires opening space for the teeth crowded out of the arch: <ul style="list-style-type: none"> o Compressed coil spring. o Crimped stops on the wire just in front of the molar tube. → Archwire is protruded. (slightly advanced from the crowded incisors). <p>→ Incisor proclination is about the same amount for both methods.</p>
Properties of alignment arches	<ul style="list-style-type: none"> - Ideal wire: Flat load-deflection curve delivering about 50 gm force (optimal force for tipping). - <u>A-NiTi:</u> <ul style="list-style-type: none"> o Superelastic wire almost totally passive in the cold form, but delivers the desired force at mouth temperature. (E-modul Martensit ~ 40 MPa, Austenit ~ 80 MPa) o Light force over a large range. o Almost no alternatives. o Wire size is a concern primarily with respect to clearance in the bracket slot. o Chilling a segment of the wire (= transformation to Martensit phase) to make it temporarily passive can be a sign. advantage under some circumstances. - <u>Triple strand 17.5 mil multistranded ss wire (3x8 mil)</u> <ul style="list-style-type: none"> o Alignment time equivalent to A-NiTi if recontoured and retied with elastomeric ligatures monthly. o The flexible archwire allow teeth to move relative to each other during mastication, which releases binding and allows sliding of the bracket along the archwire. o Pro: Cheaper o Contra: <ul style="list-style-type: none"> ▪ Chairside time ↑ ▪ Force levels more variable ▪ Patient's discomfort ↑ <p>→ No longer recommended.</p> <ul style="list-style-type: none"> - Wire with similar performance to multistranded ss wire: <ul style="list-style-type: none"> o M-NiTi. o Variety of more elaborate multistranded wires (coaxial wires). o Loops in small diameter SS-wires.
Principles in the choice of alignment arches	<ul style="list-style-type: none"> - Tooth buds can develop in the wrong place, but the root apices are likely to be close to their correct position. Exception: If all tissues are displaced in an area like for CLP or severe lip pressure in cl.II:2. → Combination of labiolingual and mesiodistal tipping needed for alignment, but no root movement. - Initially light continuous forces of approx. 50 gm to produce efficient tipping are recommended. Avoid heavy forces.

	<ul style="list-style-type: none"> - Archwires should move freely within the brackets. <ul style="list-style-type: none"> o Minimum 2 mil (optimum 4 mil) clearance between the archwire and the bracket needed for mesiodistal sliding. More clearance has no additional benefit. o Archwire hold loosely in the brackets. - Normally avoid rectangular archwires esp. with a tight fit within the bracket slot to avoid apex movement. <ul style="list-style-type: none"> o Superelastic NiTi wires cannot torque roots, but produce mesial-distal movement of root apices which can slow down the tipping movement needed for alignment → back and forth movement of the root apex occurs before the tooth ends up in essentially the same position like with round wires. o Possibility for root resorptions. o Prefer round wires.
	 <p>The diagram illustrates two scenarios of archwire placement relative to orthodontic brackets. In part A, the archwire is positioned with excessive clearance, indicated by a dashed line representing the bracket width and a solid line representing the wire. In part B, the archwire is placed with optimum clearance, allowing for mesiodistal movement of the teeth while maintaining a firm grip on the brackets.</p>
	<ul style="list-style-type: none"> - The springier the wire, the more symmetrical the crowding should be. → Risk otherwise that the archform is lost when asymmetric irregular teeth are brought into alignment. (all other teeth experience a displacement force) - Prevent archwire travel: <ul style="list-style-type: none"> o Crimp a stop between any 2 brackets which are close together. o Cinch the end of the wire.
Asymmetric crowding	<ul style="list-style-type: none"> - Rigid archwire at the sides where the teeth are already aligned + a springy auxiliary superelastic wire if only one tooth is crowded out or an impacted tooth is brought into line. - If a superelastic wire is tied into an asymmetric malaligned arch, teeth distant to the site of malalignment will be moved. - Place a stiff main arch in all but the misaligned teeth + an auxiliary spring. Add a segment of superelastic NiTi in the brackets on top of the main archwire / tie it below the brackets of the anchor teeth and tie it to the brackets of the displaced tooth. 
Arch expansion for alignment	<ul style="list-style-type: none"> - Arch length must be increased for alignment in non-ex cases if crowding exists. - Limits for arch length increase: <ul style="list-style-type: none"> o Esthetics. o Post-tx stability. - <u>Methods to increase arch length:</u> <ul style="list-style-type: none"> o Crimp a stop on the wire at the molar tube to hold the wire in front of the incisors. If a broad arch is used, transverse expansion over the premolars happens. Cave: Potential to carry the incisors facially. → Indicated only if incisor protrusion is desired. o Bypass the brackets on teeth which are lingually crowded and place coil springs over the A-NiTi. The archwire must be free to slide forward through the molar tube and slightly be too long initially so that it will not come out of the tubes. → Cave: Also, some proclination of the incisors / distortion of the archform if the force is too heavy. o Transverse expansion in the molar and premolar region. Cave:

	<ul style="list-style-type: none"> - Risk of fenestrations. - Expansion in the canine region cannot be avoided. - Heavy force which opens the midpalatal suture is not indicated to gain space for a crowding without a transversal deficit.
Alignment in premolar extractions situations	<ul style="list-style-type: none"> - Efficient alignment without incisor protrusion can be obtained with the combination of a small superelastic wire in the bracket slots and NiTi springs to retract the canines. - <u>Severe crowding:</u> Possibility to simultaneously tip the canines distally and align the incisors: A-NiTi archwire with exaggerated reverse curve of Spee (limit forward tipping of the molars) + a A-NiTi coil spring from the 1st molars to tip the canines distally. - <u>Extremely severe crowding:</u> Retract canines independently before placing attachments on the incisors. → Avoid a round trip.

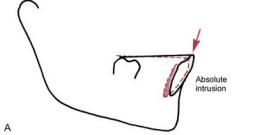
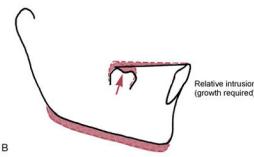
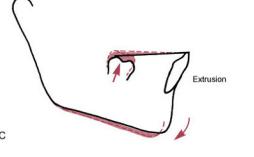
Crossbite correction (that are largely dental)	
<ul style="list-style-type: none"> - Skeletal CBs should be addressed prior to alignment. - Dental CBs: <ul style="list-style-type: none"> o Posterior CB / mild anterior CB (1-2 teeth): Correct in the first stage of tx. o Severe anterior CB (all teeth): Correct in the 2nd stage of tx or even surgical. o Correction usually provides more space for the alignment. 	
Individual teeth displaced into an anterior CB	<ul style="list-style-type: none"> - = Expression of a severe crowding in most cases: → Opening the space, brings the tooth back. - Occlusal interference can make tx difficult: <ul style="list-style-type: none"> o Use temporary biteplates to create vertical space for tooth movement. Cave: <ul style="list-style-type: none"> ▪ Elongation of posterior teeth ▪ Mn downward & backward rotation. o During adolescence with rapid growth, trapped incisors in CB can correct without opening the bite. o The older the patient, the more biteplates are needed. - CB of > 2 teeth = Probably cl.III patient. → Dental correction is indicated only if camouflage tx is attempted.
Transverse maxillary expansion by opening the midpalatal suture	<ul style="list-style-type: none"> - Can provide enough space to make extractions unnecessary. (Don't use RPE to create space in individuals with normal mx width) - <u>Late mixed / early permanent dentition:</u> <ul style="list-style-type: none"> • SPE is more physiologic and equally effective as RPE. • Up until age 15 y, it is almost always possible to open the suture. • <u>Bonded expander:</u> <ul style="list-style-type: none"> o Easier to place. o Indicated for patients with excessive anterior face height. → Occlusal force against the acrylic reduces the extrusion and the mn downward-backward rotation which accompanies mx expansion. • <u>Banded expander:</u> Almost always some mn rotation, created by occlusal interferences as the teeth move. - <u>Older patients:</u> <ul style="list-style-type: none"> • RPE (SPE is likely to produce only dental expansion). • SARPE if the suture does not open.
Correction of dental posterior crossbites	<p>Tx possibilities:</p> <ul style="list-style-type: none"> - <u>Heavy labial expansion arch:</u> <ul style="list-style-type: none"> • Cave: Outward tipping of the crowns. • Patients with HG: Expand the inner bow. → Almost always needed for correction of a cl.II molar relationship. - <u>Expansion lingual arch:</u> <ul style="list-style-type: none"> • Must provide adequate springiness and range of action. • Flexibility ↑ = <ul style="list-style-type: none"> o Better for tooth movement o Anchorage stability ↓ - <u>Cross-elastics:</u> <ul style="list-style-type: none"> • Effective, but strong extrusiv component. <ul style="list-style-type: none"> o Adolescents: <ul style="list-style-type: none"> ▪ Tolerated. ▪ Some extrusion can be compensated by growth of the ramus. o Adults: Careful application. • May use a lingual arch in the mn to avoid lingual tipping of the molars. - Removable appliances should be reserved for the mixed dentition. - Biteplates to separate teeth tightly locked into a posterior CB can make correction easier and faster. - Cave: Downward-backward rotation of the mandible often results with any tx approach for posterior CB.

Impacted or unerupted teeth	
<ul style="list-style-type: none"> - Procedure: <ol style="list-style-type: none"> 1. Surgical exposure. 2. Bonded attachment on the tooth. 3. Orthodontic mechanics to bring the tooth into the arch. - Same technique for incisors / canines & premolars. Different approach for lower 2nd molars. - Predictors for successful eruption of ectopic canines: <ul style="list-style-type: none"> o Prepubertal skeletal maturation. o Open root apex. o Vector of displacement not severe. 	<ul style="list-style-type: none"> - The tooth must erupt through the attached gingiva, not through the alveolar mucosa. → Otherwise tissues will tip away from the crown, leaving an unsightly and periodontal compromised gingival margin. - Prior CBCT is recommended. Information gained can affect the tx plan. (how the impacted tooth is moved away from the roots and aligned) - <u>Exposure labially positioned mx canines or mn canines:</u> <ul style="list-style-type: none"> o Laser: Indicated if the tooth is not covered with attached tissue. o Flap: <ul style="list-style-type: none"> ▪ Indicated for more severe displaced teeth. ▪ Attached gingiva should be transferred and sutured to the region where the crown is exposed. o Tunnel method: Alternative to a flap for very high positioned canines. - <u>Palatally positioned mx canines:</u> Gingiva problems are not an issue and an open exposure can be used. - <u>Teeth with incomplete root formation:</u> Delay orthodontic traction: → Teeth obligingly erupt in the correct position after obstacles have been removed. - <u>Teeth with completed root formation:</u> Favorable spontaneous movement rarely occurs.
Method of attachment	<ul style="list-style-type: none"> - Place a button or a hook to the exposed crown area and place a fine gold chain to the attachment. - If bonding is not possible, place a pin in a hole prepared into the crown. Cave: Very invasive. - Don't place a wire ligature around the crown: <ul style="list-style-type: none"> o Loss of periodontal attachment. o Chance of ankylosis ↑.
Mechanical approach for aligning unerupted teeth	<ul style="list-style-type: none"> - The cells in the follicle that allow bone resorption around the enamel are no longer present after the surgical intervention. → Any bone left in the direction of the impacted crown movement will be difficult or impossible to become resorbed. - Adequate bone needs to be removed, so that no enamel-to-bone contacts are created while the tooth is brought into the mouth. - Move the tooth away from other permanent teeth and then towards the line of the arch as soon as possible after the surgery. Maximum 2-3 w delay after surgery. - A fixed appliance should be in place before the unerupted tooth is exposed. Presurgical tx should create enough space if it does not exist and allow to place a heavy stabilizing archwire. - Bring the exposed tooth down: <ul style="list-style-type: none"> • Auxiliary NiTi wire. • Alignment spring soldered to a heavy base archwire or bent into a light archwire. • Cantilever spring from the auxiliary tube of the first molar. • Magnetic force for mx teeth. (one magnet on the unerupted tooth, one on a palate covering removable appliance)

	<ul style="list-style-type: none"> - Palatal impacted canines: <ul style="list-style-type: none"> o Open exposure often leads to a downward drift. → Immediate active tx can be deferred for most patients. - Cave: Ankylosis is likely to occur during alignment of impacted teeth. → Tooth can sometimes be freed by anesthetizing the area and slightly luxating the tooth in order to break the area of ankylosis. Orthodontic force must be applied immediately after the luxation.
Unerupted / impacted lower 2 nd molars	<ul style="list-style-type: none"> - Mesial tipped molars in the mixed dentition often correct spontaneously when 6-6 drift mesial. - Usually develops during orthodontic tx: Moving the 1st molar posteriorly during the mixed dentition, increases the chance for impaction of a 2nd molar. → Delay or avoid banding lower 1st molars. - <u>Therapy:</u> <ul style="list-style-type: none"> • Tip the tooth posterior and upright it by placing a separator. If the mesial marginal ridge can be unlocked, the tooth will erupt on its own. • <u>More severe cases:</u> Bond an attachment on the 2nd molar and place an auxiliary spring from the 1st to the 2nd molar. (e.g. 16x22 M-NiT overlay arch if a fixed appliance is in place) • <u>Adolescents:</u> Surgical upright the impacted 2nd molar in the space of a simultaneously extracted 3rd molar. Vitality is retained as the tooth is only rotated around the apex. The outcome is best, when some vertical jaw growth remains so that the 2nd molar is not elongated in relation to the 1st molar.

Diastema closure

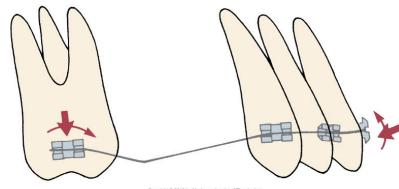
Frenulum	<ul style="list-style-type: none">- Frenectomy:<ul style="list-style-type: none">o Simple incision to allow removal of interdental fibrous tissues. Remove the fibrous connection to the bone and suture the frenulum at a higher level.o Don't excise a large portion of the frenulum itself.- Align the teeth before frenectomy:<ul style="list-style-type: none">o <u>Relatively small diastema</u>: Teeth can normally be brought together before surgery.o <u>Large space & thick frenulum</u>: Space can maybe not completely be closed before surgery. A reduction should be achieved before surgery and closure resumed immediately after the frenectomy.o Better slide the teeth along an archwire instead of a closing loop. → Vertical height of the loop will touch and irritate the frenulum.- Avoid frenectomy at an early age in the hope that the diastema will close spontaneously. → Scar tissue is formed between the teeth and a long delay until orthodontic tx starts makes the diastema closure maybe more difficult.- Bonded fixed retainer for retention. (no elastic gingival fiber network which cross the midline)
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Leveling	
  	<ul style="list-style-type: none"> - Possibilities to level out an excessive curve of Spee: - Absolute intrusion: Indicated normally for patients who are too old for relative intrusion. - Relative intrusion: = Achieved by preventing eruption of the incisors while growth provides vertical space into which the posterior teeth erupt. (differential elongation of premolars) The ramus grows while tooth movement occurs. Quite acceptable for adolescents. - Extrusion of posterior teeth: → Causes the mandible to rotate down- & backwards in the absence of growth.
Leveling by extrusion (relative intrusion)	<ul style="list-style-type: none"> - Place an exaggerated curve of Spee in the mx archwire and a reverse curve of Spee in the mandibular archwire. - 18-Slot, narrow brackets: <ul style="list-style-type: none"> - 16 mil steel archwire after initial alignment. - If no growth is remaining: Auxiliary leveling arch 17x25 mil TMA / steel arch inserted into the auxiliary tube on the molar and tied anteriorly beneath the 16 mil base arch. → Curve in the base arch is augmented. - 22-Slot, wider brackets: <ol style="list-style-type: none"> 1. Initial alignment with A-NiTi. 2. 16 mil steel wire with a reverse or accentuated curve of Spee or 16 mil A-NiTi with a reverse curve of Spee. → If little growth is remaining: 18 mil ss wire with a reverse or accentuated curve of Spee. 3. 18 mil ss round wire to complete the leveling. - Don't place a rectangular archwire with an exaggerated curve of Spee in the mn arch with either slot size → Curve creates torque to move the incisor roots lingually. Acceptable in the maxilla if some lingual root torque of the upper incisors is needed - The arches should be leveled before a rectangular wire is placed.
Leveling by intrusion	<ul style="list-style-type: none"> - Avoid pitting intrusion of one tooth against extrusion of its neighbor. → Extrusion will dominate. - Preston, 2008: Stability of leveling with continuous archwires or sectional intrusion archwires is equally stable. - Intrusion requires segmented base arches and a light intrusive force: About 50 gm for 321-123. - Intrusion is essentially impossible with a continuous arch wire, but an auxiliary leveling archwire can be useful in augmenting the leveling force from a wire tied into the brackets. - Extrusion can be done with a segmented or continuous archwire by using about 50 gm per tooth in the segment to be extruded.
1. Bypass arches:	<ul style="list-style-type: none"> - = Continuous archwire that bypasses the premolars and frequently the canines. Examples: <ul style="list-style-type: none"> • Originally used in the Begg technique (premolars bypassed, only loosely tied around the canines) • Ricketts's utility arch (rectangular wire) - Idea: Uprighting and distal tipping of the molars is pitted against intrusion of the front teeth - Indication: Patients with a lot of vertical growth. (to compensate molar extrusion)



- Methods:
 - 2x4 appliance or
 - Premolars & canines are bypassed (not tied in the main archwire)

→ The long span of a 2 × 4 appliance makes it possible to create the light force necessary for incisor intrusion and also makes it possible to create unwanted side effects. This appliance is best described as deceptively simple. When incisor intrusion is desired before other permanent teeth can be incorporated into the appliance, a transpalatal lingual arch for additional anchorage is a good idea.
- Clinical use:
 - Use light arches e.g. **16x22 B-TMA**, maximum 16 mil ss.
 - Overactivation of the vertical bends can cause loss of the molar control.
- Contras:
 - Limited amount of intrusion can be achieved.
 - Only the first molar is available for anchorage.
(expect in some applications of the utility arch)
→ Sign. extrusion of the posterior teeth can occur → toleration only in growing patients.
 - The intrusive force is applied anterior to the incisors:
 - Trend to forward tipping during intrusion.
→ This can be counteracted by cinching the wire back, but this moves the molars mesially.
 - Utility arch:
 - = rectangular shape → can be activated (like a closing loop) to keep the incisors from moving forward and twisted to control the tipping.
Force system of the 3rd order can increase or compensate the vertical equability forces. (*Davidovitch + Rebellato, 1996*)
 - → Cave: Strain on the posterior anchorage, intrusive force cannot be controlled.



Diagrammatic representation of the forces for a leveling arch that bypasses the premolars, with an anchor bend mesial to the molars. A force system is created that elongates the molars and intrudes the incisors. The wire tends to slide posteriorly through the molar tubes, tipping the incisors distally at the expense of bodily mesial movement of the molars. An archwire of this design was used in the first stage of Begg treatment but also can be used in edgewise systems. A long span from the molars to the incisors is essential.

2. Segmented arches and an auxiliary depression arch



- Developed by Burston.
- No connection of the anterior and posterior arch segments.
- Method:
 - **Full dimension rectangular archwires** placed into the brackets slots of the teeth in the buccal segments for stabilization.
 - **Heavy lingual arch** (36 mil round / 32x32 rec. steel wire) to connect right and left posterior segments.
 - Resilient anterior segmental wire used to align the incisors while the posterior segments are being stabilized.
 - For intrusion:
 - Auxiliary arch in the auxiliary tube on the 1st molar applying intrusive force against the anterior segment.
 - Choose a rectangular wire that will not twist:
17x25 steel / 19x25TMA.
 - The wire lies gingival to the incisor teeth when it is passive and applies a light force → tied underneath or in front of the incisors.
 - Applied force: **~10 gm per tooth / 150 gm with continuos archwire**
 - The light resilient anterior segment can be used to align malpositioned incisors together with the auxiliary intrusion archwire. But usually better wait until alignment has been achieved and a heavier anterior segmental wire (rectangular ss or TMA) can be installed.