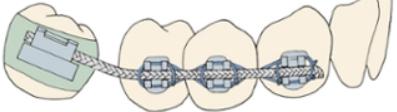
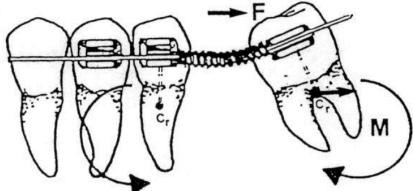
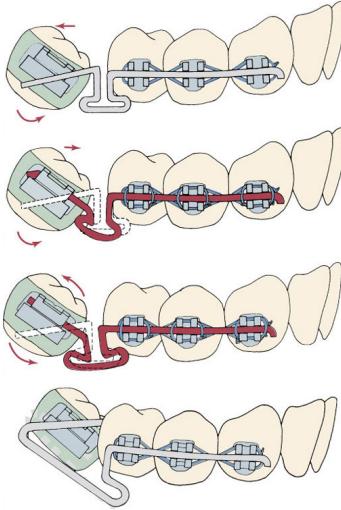
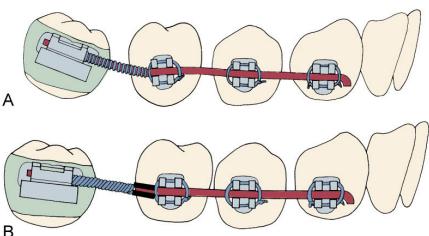


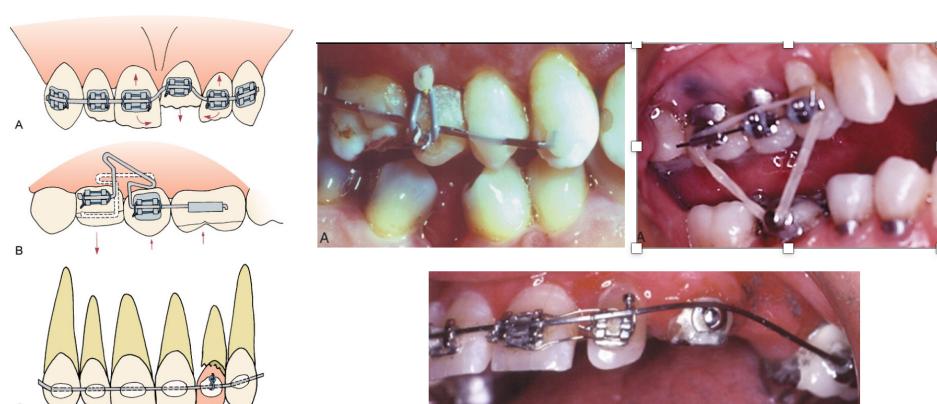
Effects of reduced periodontal support	<ul style="list-style-type: none"> - Bone loss → decrease of PDL area → same force against the crown produces greater pressure in the PDL compared to a normally supported tooth → Absolute magnitude of force used to move teeth must be reduced. - Attachment loss ↑ → center of resistance further apical (healthy tooth: 6/10 of the distance between the apex of the tooth and the crest of the alveolar bone) → Larger moments are created by force application to the crown. - Available anchorage ↓ → consider skeletal anchorage. - Permanent retention necessary. - If root movement is desired: Fixed appliances necessary to create the large moments needed. <p>Lighter forces and larger moments to control root movement are needed for tx.</p>
Adjunctive treatment procedures: Uprighting posterior teeth	<p>Tx planning considerations after early loss of 1st molar to upright a 2nd molar</p> <ul style="list-style-type: none"> - If the 3rd molar is present: Distal positioning of the 3rd molar moves it to a position in which good hygiene cannot be maintained and there is no functional occlusion. → Extract 3rd molar, upright 2nd molar. - Tx by distal tipping of the 2nd molar is preferred to mesial root movement. → Root movement happens very slowly if extensive ridge resorption has occurred, but may eliminates the need for prosthesis. → Uprighting with space closure often requires temporary skeletal anchorage. - Uprighting a mesial tipped tooth also extrudes it: → Depth of the pseudopocket is reduced mesial. Attached gingiva follows the cementoenamel junction while the mucogingival junction remains the same → width of the keratinized tissue is increased. - Improved crown-root ratio if the height of the clinical crown is reduced. (routine part of molar uprightness).
Appliances for molar uprightness	<ul style="list-style-type: none"> - Tube or band on the molar, brackets on the premolars & canine bonded passively or active to move the teeth. - Bands are best when the periodontal conditions allows it. (bonded attachment on teeth with severe periodontal breakdown)

<p>Uprighting a single molar:</p> <p>1. Distal crown tipping</p>	<ul style="list-style-type: none"> - <u>Moderately tipped molars</u> <ul style="list-style-type: none"> • Flexible rectangular wire (17x25 A-NiTi), 100 gm force • Braided rectangular steel wire as alternative. Often removal and reshaping required. • The occlusion must be relieved while the tooth tips upright.  <ul style="list-style-type: none"> - <u>Druckfeder:</u> <p>Druckfeder: Druckfeder um 1/3 der ursprünglichen Länge komprimieren</p> <p>Kl.III Geometrie</p>  <p>Molaren: Drehmoment der Geometrie und der Stossfeder addieren sich. Extrusion.</p> <p>Verankerungssegment: Drehmomente gegenläufig. Inrusion über viele Zähne verteilt.</p> <p>Attachment im Kronenbereich -> Translation und Rotation; die Kraft der Stossfeder bewirkt ein Drehmoment, dazu kommen Drehmomente vom einligierten geraden Draht (Burston III), dadurch entstehen die vertikalen Kräfte (Extrusion des Molaren, Inrusion PM)</p> <p>Ind: Lücken im PM – Bereich, distal abgewanderte PM Kontraind: Protrudierte Frontzähne</p> <ul style="list-style-type: none"> - <u>Severely tipped molars:</u> <ul style="list-style-type: none"> • Use a sectional spring to prevent side effects on the premolars. 1. Preliminary alignment of the anchor teeth, 19x25 ss wire for retention of the anchor teeth. 2. Auxiliary spring in the molar tube: <ul style="list-style-type: none"> ◦ 17x25 TMA without a helical loop or 19x25 ss with a loop. ◦ Mesial arm of the spring should be adjusted to lie passively in the vestibule and upon activation should hook over the archwire in the stabilizing segment ◦ The hook should be positioned so that it is free to slide distally as the molar uprights ◦ Lingual bend in the spring to counteract forces which tend to tip the anchor teeth buccally and the molar lingually. (because the force is applied to the buccal surface)
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	<ul style="list-style-type: none"> - A bonded lingual stabilizing wire from canine-to-canine should be placed to control the incisor position if molars are uprighted on both sides simultaneously. - Tx time: <ul style="list-style-type: none"> o 8-10 w. o Failure to eliminate occlusal interferences prolong tx. o If 2 molars are uprighted in the same quadrant: 6 m. - <u>Aufrichtefeder: Tip-back Feder (One-Couple-System)</u> <ul style="list-style-type: none"> - 016x022 Stahldraht, Schlaufendurchmesser 3mm, Helixanzahl: 2.5 Windungen - 017x025 TMA ohne Helix - effiziente Molarenaufrichtung: Drehmoment: 2000-3000gmm - Variierung des Momentes: Aktivierungswinkel ↑ -> Moment ↑, F vert. ↑ Akt. Winkel konst., Länge ↑ -> F vert. ↓ in der 3. Potenz, Moment ↑. (Das Moment ändert sich prop. Zur Länge, die Kraft ändert sich in der 3. Potenz zur Länge aufgrund der Federrate) <p>Nebeneffekt: Extrusion des Molaren, Intrusion PM Entstehung von ev. Interferenzen (cave bei Erwachsenen-TH)</p> <ul style="list-style-type: none"> - <u>Aufrichtefeder ohne vertikalen Kräfte (Two-Couple-System)</u> <ol style="list-style-type: none"> 1. Bogen passiv biegen. 2. Gleich starke Aktivierung am mesialen und distalen Ende. <p>→ Gleiche starke, einander entgegengesetzte Momente. → Keine vertikalen Kräfte.</p> <ul style="list-style-type: none"> - Teilbogen aus geradem 017x025 TMA - Passiv im Attachment vom PM und Molaren - 45 Grad Aktivierung nach Gingival in alpha und beta- Position -> Burston VI, keine vertikalen Kräfte
Uprighting a single molar: 2. Mesial root movement	<ul style="list-style-type: none"> - Skeletal anchorage is needed if the extraction space should be closed. - <u>If goal = small amount of mesial movement:</u> <ul style="list-style-type: none"> • T-loop sectional archwire 17x25 ss or 19x25 beta-Ti adapted to fit passively into the brackets on the anchor teeth (after initial alignment) and gabled at the T to exert an uprooting force on the molars. • Insertion on the molar from mesial (normal case) or distal (severely tipped or rotated molars) - <u>If goal = maintain or close the pontic space:</u> <ul style="list-style-type: none"> • The distal end of the archwire should be pulled through the molar tube, opening the T-loop by 1-2 mm and the wire end bent sharply gingival to maintain the opening. - <u>If goal = opening the space:</u> <ul style="list-style-type: none"> • End of the wire is not bend over → tooth can slide distally along it. (the T-loop is also opened) - The T-loop is also indicated if the molar to be uprooted is severely tipped but has no occlusal antagonist → T-loop minimizes the extrusion that accompanies the uprooting.

		<p>(A) T-loop spring in 17×25 steel wire, showing the degree of angulation of the wire before it is inserted into the molar tube that is necessary to upright a single-tipped molar. (B) If a T-loop is activated by pulling the distal end of the wire through the molar tube and bending it, the tooth cannot move distally. This generates a moment that results in molar uprightness by mesial root movement with space closure. (C) A T-loop for uprightness by distal tipping. Note that the tooth can move back by sliding along the wire. (D) Modification of a T-loop that can be used to upright a severely tipped or rotated molar by distal tipping. The wire is inserted into the distal end of the tube on the molar. The additional wire in the loop provides a longer range of action, but the uprightness still is by distal crown tipping.</p>															
NiTi-SE-Stahl-Aufrichtefeder nach Sander / Wichelhaus:	<ul style="list-style-type: none"> - Superelastischer Draht beim Molaren mit Tip- back- Abwinkelung 15° (016x022) - Klemmverbindung zu Stahldraht (017x025) - Kreuzröhren distal Eckzahn - Verblockung der Zähne mit 8er Ligatur, um Mesialisierung der Wurzel zu erreichen, resp. Distalkippung der Krone zu verhindern <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Winkelverhältnis</th> <th>Konstruktion Aufrichtefeder</th> <th>Kräfte und Momente</th> </tr> </thead> <tbody> <tr> <td>$\alpha = \beta$</td> <td></td> <td></td> </tr> <tr> <td>$\alpha > \beta$</td> <td></td> <td></td> </tr> <tr> <td>$\alpha < \beta$</td> <td></td> <td></td> </tr> <tr> <td>$\alpha < \beta$ $\alpha = \beta + \text{Stufe}$</td> <td></td> <td></td> </tr> </tbody> </table> <ul style="list-style-type: none"> - 1. $a = b$: ohne vertikale Kompensationskräfte - 2. $a > b$: Aktivierung bei a ist stärker, dadurch Kompensationskräfte in umgekehrter Richtung (Extrusion bei a, Intrusion beim Molaren) - 3. $a < b$: kleineres Moment am Verankerungssystem, Molar wird stärker aufgerichtet als bei 2., erfährt aber eine Extrusion - 4. 3. + Stufe: Verstärkung der vertikalen Stufe führt zur Vergrößerung der vertikalen Kräfte: Intrusion des Molaren, Extrusion der Front, zudem entsteht ein kleineres Aufrichtemoment für den Molaren, sowie ein grösseres Drehmoment für den Verankerbereich (2-3x)(Summe der Kräfte = 0) 		Winkelverhältnis	Konstruktion Aufrichtefeder	Kräfte und Momente	$\alpha = \beta$			$\alpha > \beta$			$\alpha < \beta$			$\alpha < \beta$ $\alpha = \beta + \text{Stufe}$		
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Uprighting a single molar: Final positioning of the molar and premolars	<ul style="list-style-type: none"> - Stiff base wire 1 mm extended distal the molar tube with a compressed coil spring 1-2 mm longer than the space (150 gm). Reactivation is possible by placing a split sparer over the wire. → The spaces between the premolars are closed & the pontic space opened. 																

Uprighting 2 molars in the same quadrant	<ul style="list-style-type: none"> - Attempt only small amounts of space closure as the resistance is considerable. - The goal should be a slight distal tipping of both crowns for a premolar-size pontic or an implant. - Uprighting 2nd & 3rd molars bilaterally is a bad idea, unless skeletal anchorage is used to avoid considerable movement of the anchor teeth. - Lower arch: A bonded canine-to-canine retainer is needed to control the position of the anterior teeth. - <u>If 2nd & 3rd molar are planned to be uprighted:</u> <ul style="list-style-type: none"> • Single rectangular tube on the 3rd molar, bracket on the 2nd molar. (increased flexibility of the wire mesial and distal of the 2nd molar needed, as it is often more severely tipped) • High flexible wire: 17x25 A-NiT • If excessive tooth mobility is present, reduce occlusal interferences.
Retention of uprighted molars	<ul style="list-style-type: none"> - Avoid a long delay until making the final prosthesis. - A fixed bridge can and should be placed within 6 weeks after uprightness is completed. - If a longer retention is needed (i.e. for a bone graft prior to implant placement): <ul style="list-style-type: none"> • Intracoronal wire splint (= A-splint) made from 19x25 or heavier ss bonded into shallow preparations in the proximal enamel of abutment teeth.
Adjunctive treatment procedures: Crossbite correction	
Elastics	<ul style="list-style-type: none"> - Tipping the teeth into the correct position also extrudes them at the same time. → Cave: The occlusal relationships throughout the mouth could be damaged. - Stabilize several teeth in the lower arch by a heavy archwire segment to obtain more movement of a mx tooth than its antagonist (or the opposite). - Elastics are rarely indicated for anterior teeth. - <u>Mesial tipped lower molars in a buccal crossbite:</u> An uprightness spring can move it lingually by modification of the design: <ul style="list-style-type: none"> • Omit the inward bending of the spring before activations. • Make the spring from a round wire.
Anterior crossbite due to a displaced tooth 	<ul style="list-style-type: none"> - Tip the tooth in a correct position with a removable appliance or clear aligner. → Cave: Tipping of a tooth also changes the occlusal level = OB. → Relapse must be anticipated if a negative OB is created! - Fixed appliances are necessary for vertical control during the correction. - Use a temporary bite plane to free the occlusion if a deep OB exists. Cave: All occlusal surfaces of the teeth must be in contact with the plate to prevent supereruption during tx. The bite plate can be removed as soon as the patient can bite behind the tooth which was in crossbite.
Retention	<ul style="list-style-type: none"> - Good OB = Key to maintain crossbite correction. - Crown reconstruction can help to provide positive occlusal indexing while eliminating any balancing interferences from the lingual cups of posterior teeth.
Adjunctive treatment procedures: Extrusion = Forced eruption	
Indications	<ul style="list-style-type: none"> - Alternative to crown-lengthening surgery for defects in or adjacent to the cervical third of the root. - Allow placement of a rubber dam for endodontic therapy. - Allow the crown margins to be placed on sound tooth while maintaining an uniform gingival contour with improved esthetics. - Isolated one or two-wall vertical pockets: <ul style="list-style-type: none"> • Surgery is maybe contraindicated in the anterior region for esthetic reasons. • Forced eruption + concomitant crown reductions can improve periodontal conditions with improved esthetics.

Biology	<ul style="list-style-type: none"> - Alveolar bone height is not compromised. - Apparent crown length is maintained. - Attached gingiva follows the cementoenamel junctions, mucogingival border remains mostly on the same level: → Width of the attached gingiva returns to its original level. - Usually some recontouring of the gingiva & often recontouring of the bone necessary to produce an even contour between adjacent teeth and a proper biologic width. - Control of apical infections should be completed before extrusion. → Only temporary root filling, if the access must be improved first.
Procedure principles	<ul style="list-style-type: none"> - <u>Determination how much a tooth must be extruded:</u> - Location of the defect. - Space necessary to place the margin of the restoration so that it is not at the base of the gingival sulcus (typically 1 mm needed). - Allow enough space to respect the biologic width of the gingival attachment. (about 2 mm) - Size of the pulp chamber or the root canal at the level of the margin of the future restoration. - Crown-root ratio should be 1:1 or better at the end of tx. → Splinting to adjacent teeth is necessary if this cannot be achieved. - Rate: 1 mm/w extrusion is possible without damage to the PDL. - Too much force / too rapid movement runs the risk of damaging the tissue and risk for ankylosis. - Control appointment every 1-2w: Any occlusal contact which could impede eruption must be removed. - Ample anchorage is usually available from anchor teeth as extrusion occurs more easily compared to intrusion. - Retention minimum 3 weeks, but not more than 6 weeks after completion of tooth movement necessary to allow reorganization of the PDL. - Periodontal surgery to recontour the alveolar bone / reposition the gingiva can be done a month after completion of extrusion - Complete definitive prosthetic tx without extensive delay.
Orthodontic technique	<ul style="list-style-type: none"> - <u>Extrusion of anterior teeth:</u> The appliance needs to be quite rigid over the anchor teeth and flexible where it attaches to the tooth, which should be extruded. <ul style="list-style-type: none"> o A: Continuous archwire Cave: adjacent teeth tend to tip towards the tooth being extruded, reducing the space available. <i>Note: Horizontal forces from Bantleon effect?</i> o B: Flexible cantilever spring wire (e.g. segmental T-loop) o C: Rigid stabilizing wire and an auxiliary elastomeric module or spring for extrusion  - <u>Severely intruded posterior teeth, option 1:</u> <ol style="list-style-type: none"> 1. Stabilizing wire 19x25 or 21x25 ss bonded direct to the facial surface of the adjacent teeth. 2. Post and core with a temporary crown and pin placed on the tooth to be extruded. 3. Elastomeric module used to extrude the tooth / interarch elastics or a flexible archwire <p>→ Simple appliance with excellent control of the anchor teeth. → Better control can be obtained when orthodontic brackets are used.</p> - <u>Severely intruded posterior teeth with completely destroyed crowns, option 2:</u>

	<ul style="list-style-type: none"> ○ Place an orthodontic band with a bracket on the remaining root surface. → The band also helps for isolation procedures for endodontic tx. ○ Bond adjacent teeth to serve as anchor unit
Adjunctive treatment procedures: Alignment of anterior teeth	
Diastema closure / space redistribution	<ul style="list-style-type: none"> - Do a diagnostic setup for tx planning. - <u>Options 1:</u> Partial fixed appliance with bonded brackets on most if not all the maxillary teeth and a bonded tube 6+6 for additional anchorage. <ul style="list-style-type: none"> • Initial alignment with light wires. • Reposition the teeth with elastomeric modules or coil springs. • Bond a flexible wire on the lingual surface after the diastema closure to prevent space reopening. - <u>Option 2:</u> Sequence of clear aligners. <ul style="list-style-type: none"> • For modest tooth movements: Aligners made by resetting the teeth on a dental cast that can be reshaped by the doctor. • For extensive tooth movements: Invisalign. Cave: Rather comprehensive than adjunctive tx.
Crowded, rotated and displaced incisors	<ul style="list-style-type: none"> - Lack of space is mostly the problem. - Option 1: Arch expansion: Done by clear aligners or a partial fixed appliance (more efficient and cost-effective) if aesthetics are no concern. <ul style="list-style-type: none"> • A segment of A-NiTi wire with stops to make it slightly advanced: = usually best way to bring the teeth into alignment. - <u>Option 2: Stripping:</u> <ul style="list-style-type: none"> • Indicated for mildly crowding situations. • Cave: Effect on OJ, OB, posterior intercuspatation and esthetics. - <u>Option 3 (comprehensive tx): Remove one lower incisor.</u> - Good long-term stability maybe requires fibrotomy. - Retention is necessary until restorative or other tx is completed.

Comprehensive treatment in adults	
Psychologic considerations	<ul style="list-style-type: none"> - Children: Tend not to become emotionally involved in their tx. (Cave: Tx is sometimes in the focus of the adolescent rebellion) - Adults seek tx because they WANT it = internal motivation → More likely to respond well psychologically. - Sometimes a hidden set of motivations exists = external motivation: <ul style="list-style-type: none"> • Effort to improve the personal appearance / deal with social problems. • Discuss patient's perception with the doctor's evaluation. → Unrealistic expectations cannot be fulfilled. - Adult patients have often a more positive self-image than the average people. → Ego strength rather than weakness characterizes them. - Demand for better appearing appliances. → Cave: Always leads to tx compromises (time / possibilities...) - Visibility of an appliance is not a matter of concern esp. in the US as orthodontic tx is socially accepted. - Tx in a private area is maybe preferable for some adults, but learning from interacting with other patients helps to understand and tolerate the tx procedures. - Increased interest in tx, but not automatically more compliant with instructions. Sometimes active decision not to do it. - Less tolerant of discomfort, more likely to complain about pain after adjustments. - More difficulties in speech, eating & tissue adaptions.

Comprehensive treatment in adults: Temporomandibular dysfunction as a reason for orthodontic treatment	
Types of problems	<p>4 Groups:</p> <ol style="list-style-type: none"> 1. Masticatory muscle disorders 2. TMJ disorders 3. Chronic mandibular hypomobility 4. Growth disorders <p>- Muscle spasm and joint pathology can coexist → distinction in many patients is difficult.</p> <p>- Sources:</p> <ul style="list-style-type: none"> • Clenching, grinding (stress response) • Internal joint pathology <p>→ Both lead to muscle spasm & fatigue → TMD symptoms (pain, joint noise, limited opening).</p> <pre> graph LR A[Clenching, grinding stress response] --> B[Muscle spasm and fatigue] C[Internal joint pathology] --> B B --> D[TMD symptoms: pain joint noise limited opening] C -.-> D </pre>
Principles of tx	<ul style="list-style-type: none"> - Orthodontic tx can sometimes help patients with TMD related to excessive clenching or grinding, but it cannot be relied on to correct these problems. - No tx success for patients with internal joint problems or other non-muscular sources of pain. - Patients with myofascial pain / dysfunction may benefit from improved dental occlusion. - Patients with arthritic changes in other joints: TMJ is likely to be involved. - A component of muscle spasm and muscle pain should be suspected in patients with symptoms only in the TMJ, even if the x-ray shows moderate arthritic degeneration. - Disk (soft tissue) is best represented with a MRI. - CT/CBCT is preferred for visualization of bony changes.
Displacement of disk	<ul style="list-style-type: none"> - Can arise from several causes. - <u>Possible sequence of events:</u> <ol style="list-style-type: none"> 1. Trauma to the joint 2. Ligaments which oppose the action of the lateral pterygoid muscle are stretched or torn. Lig. Temporomandibulare = Lig. Laterale. Lig. Sphenomandibulare. 3. Contraction of the m. pterygoideus lateralis moves the disk forward as the mandibular condyles translate forward on wide opening → click. 4. The ligaments do not restore the disk to its proper position when the jaw is closed → click.
Tx of the "click" noise of the disk	<ul style="list-style-type: none"> - Occlusal splint to prevent the patient from closing beyond the point at which displacement occurs. → If the symptoms are controlled, the splint can normally gradually be reduced and later removed. - Increase of vertical facial dimension: <ul style="list-style-type: none"> • Restorative • Elongation of all posterior teeth → Adapt with care! Better ways exist to handle disk displacements than orthodontic tx.
Origin of myofascial pain	<ul style="list-style-type: none"> - Involved factors: Always BOTH must be present <ul style="list-style-type: none"> • Muscles which are overly fatigued and tend to go into spasm • Occlusal discrepancy - Muscle fatigue is always caused by clenching or grinding. It cannot be produced to this extent during normal eating and chewing. - Great variation exists how individuals respond to stress. - <i>Slade, 2016:</i> Impossible to say that occlusal discrepancies of any given degree will lead to TMJ disease symptoms

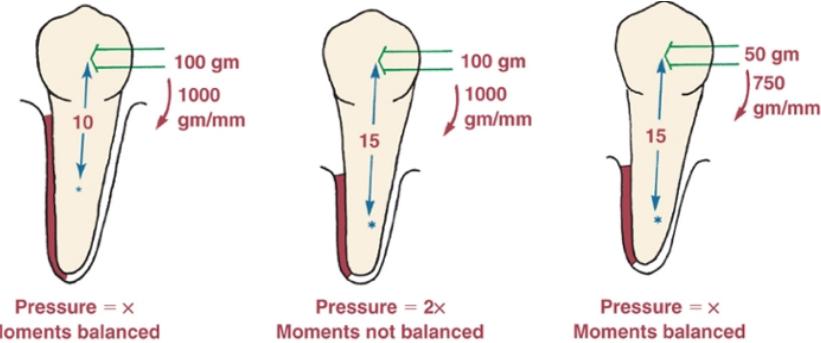
	<ul style="list-style-type: none"> - Some types of occlusal discrepancies predispose patients who clench or grind their teeth to develop TMJ disease symptoms. <p><i>McNamara:</i></p> <ul style="list-style-type: none"> • OJ > 6mm • Verlust mehrerer posteriore Zähne • Anterior offener Biss • Lateraler Zwangsbiss • Ausgeprägte RK/IK-Diskrepanz <ul style="list-style-type: none"> - BUT: TMJ disease is not more prevalent in patients with severe malocclusions than in the general population. (Okeson, 2013) <p>→ Malocclusion is not a primary cause of TMJ disease.</p>
Tx indications	<ul style="list-style-type: none"> - Tx options: <ul style="list-style-type: none"> 1. First: Stress reduction 2. Stress control / adaption 3. Improvement of the occlusion - Drastic alterations of the occlusion / orthognathic surgery may help to treat TMD, but should be performed only as second step. - Changing the occlusal relationship contributes to breaking up the habit that contributes to muscle fatigue / pain. - TMD symptoms mostly disappear with an orthodontic intervention, even before the occlusion is corrected: Teeth become sore during orthodontic tx → grinding sensitive teeth to handle stress, does not produce the same subconscious gratifications as before → parafunction stops, symptoms disappear. - Symptoms are unlikely to be present while movement of a sign. number of teeth is occurring, as long as strongly deflective contacts are avoided. - Prolonged use of cl II/III elastics in adults with TMD are not well tolerated. - TMD often reoccurs with removal of the appliance: → An occlusal splint can help.
Interocclusal splint	<ul style="list-style-type: none"> - Must cover all teeth - Cave: If the splint covers the posterior, but not the anterior teeth: → Elongation of the anterior teeth possible. → No contact of the posterior teeth. → Elongation of the posterior teeth with orthodontic tx, crowns or intrusion of the anterior teeth necessary. → Sign. increase in face height. - Orthodontic tx is difficult after splint removal: → TMD symptoms are likely to develop immediately after splint removal.
Discussion	<ul style="list-style-type: none"> - 30% incidence of clenching in the populations. - Success of TMJ surgery: 50% → Always prefer a conservative approach. - Eigenschaften KG: <ul style="list-style-type: none"> • Faserknorpel = ø primäres Wachstumspotential, wächst nur adaptiv. • Sekundärer Knorpel: Bildet sich auch Knochen, ø auf BG-Vorstufe. • Kollagen Typ 1 = ø regenerierbar. • Wachstumszone intraartikulär. • Rotation + Translation. • Beide Gelenke (re+li) miteinander verbunden. - Extremitätengelenk: <ul style="list-style-type: none"> • Hyaliner Knorpel. • Primärer Knorpel: Zone mit Säulenknorpel, BG → Knorpel. • Kollagen Typ 2. • Wachstumszone extraartikulär. • Rotation. • I.d.R. unabhängig zu Nachgelenken. - Histologie Kondylus. <ol style="list-style-type: none"> 1. Fibröse BG-Zone 2. Proliferative pluripotente Zone 3. Hypertrophe Knorperzellenschicht 4. Enchondrale Ossifikation 5. Subchondraler Knochen <p>Normaler Knorpel = Aufbau, ausgenommen dass die fibröse BG-Zone fehlt.</p>

	<ul style="list-style-type: none"> - Diskus: <ul style="list-style-type: none"> Trennt die Gelenkkammer: cranial Scherrbewegung, kaudal Scharnierbewegung. • Pars posterior: <ul style="list-style-type: none"> ◦ Elastische Fasern. ◦ Dickster Anteil. ◦ Ansatz an die bilaminäre Zone. • Pars anterior: <ul style="list-style-type: none"> ◦ Einstrahlende Fasern des M. pterygoideus lateralis Caput superior. ◦ Anzahl einstrahlende Muskelfasern ↓ → Risiko Diskusverlagerung ↑ • Pars intermedius <ul style="list-style-type: none"> ◦ Zentrisch über dem Condylus. ◦ Fasern strahlen in den Condylus ein. - Bilaminäre Zone: <ul style="list-style-type: none"> • Stratum superior: <ul style="list-style-type: none"> ◦ Elastische Fasern → ziehen den Diskus beim Mundschluss zurück. • Genu vasulosum: <ul style="list-style-type: none"> ◦ Arterio-venöser Shunt, Pufferfunktion. • Stratum inferior: <ul style="list-style-type: none"> ◦ Kollagene Fasern → Stabilisierung & Bewegungslimitation des Diskus. - Ursachen KG Beschwerden: <ul style="list-style-type: none"> • Orthopädische Instabilität • Trauma • Emotionaler Stress • Deep pain input • Muskelhyperaktivität: Bruxismus, Pressen. • Interne KG- Erkrankung: Arthrose, Tumor... - Therapie KG Beschwerden: <ul style="list-style-type: none"> • Selektives Einschleifen • Prothetische Therapie abnehmend / festsitzend • Erhöhung der vertikalen Dimension • KFO: Okklusionsänderung stoppt Habit, das zum Knirschen führt. • Schienentherapie: Prinzip = Mundschluss verhindert hinter dem Punkt wo eine Diskusverlagerung stattfindet. • Stress Reduktion / Kontrolle / Coping Mechanismen • Kombination - Ligamente involviert im KG: <ul style="list-style-type: none"> • Lig. sphenomandibulare. • Lig. temporomandibulare = Lig. laterale. • Lig. stylomandibulare. • Lig. collaterale laterale & mediale: bilden die KG Kapsel & fixieren den Diskus. ø dehnbar, nur elongierbar, spezifische Länge. <p>F: Limitation der Bewegung in Grenzpositionen, ø beteiligt bei der normalen Gelenkfunktion.</p> - Mundschliesser: <ul style="list-style-type: none"> • M. temporalis (3 Anteile) • M. masseter: 2 Anteile = Pars superficialis, Pars profundus. • M. pterygoideus medialis: Muskelschlinge mit M. masseter. - Mundöffner: Voraussetzung = Os hyoid fixiert durch die infrahyoideale Muskulatur. <ul style="list-style-type: none"> • M. mylohyoideus (bildet den Mundboden) • M. digastricus V. anterior. • M. geniohyoideus. • M. pterygoideus lateralis Caput inferior. - Retraktoren: <ul style="list-style-type: none"> • M. digastricus V. posterior. • M. temporalis Pars horizontalis. • M. geniohyoideus. - Protrusion: <ul style="list-style-type: none"> • M. pterygoideus lateralis Caput inferior symmetrisch aktiviert.
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	<ul style="list-style-type: none"> - Laterotrusion: <ul style="list-style-type: none"> • M. pterygoideus lateralis Caput inferior asymmetrisch aktiviert. (Laterotrusion zur Gegenseite) - Orthopädische Prinzipien: <ul style="list-style-type: none"> • Alle synovialen Gelenke werden durch Muskeln zusammen gehalten. • Gelenkflächen werden in Kontakt gehalten. • Der interartikuläre Druck wird durch die Muskeln um das Gelenk bestimmt. • Muskuloskeletal stabile Position = physiologische Neutralstellung. → Condylus & Diskus werden durch die KG-Muskulatur stabilisiert. - Bewegungsausmass KG: <ul style="list-style-type: none"> • Max. Mundöffnung: >42 mm • Laterotrusion >8 mm • Protrusion >7 mm
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Comprehensive treatment in adults: Periodontal considerations																						
Prevalence	<ul style="list-style-type: none"> - Young patients: <ul style="list-style-type: none"> • Periodontal diseases usually do not arise. • Higher tissue resistance: A gingivitis almost never develops into a periodontitis. • Generalized periodontitis needs a prober diagnosis → often blood disease. - <i>Moriarty, 1984:</i> <ul style="list-style-type: none"> • A nearly straight-line relationship between the age and periodontal pocketing up to the late thirties exists. • Peak of prevalence of mucogingival problems in the twenties. <table border="1"> <caption>Data from Moriarty (1984) showing the percent of patients with periodontal issues by age group</caption> <thead> <tr> <th>Age Group</th> <th>Pocketing > 5 mm (%)</th> <th>Inadequate attached gingiva (%)</th> </tr> </thead> <tbody> <tr> <td>Under 10</td> <td>5</td> <td>7</td> </tr> <tr> <td>10-19</td> <td>17</td> <td>27</td> </tr> <tr> <td>20-26</td> <td>32</td> <td>38</td> </tr> <tr> <td>27-32</td> <td>48</td> <td>28</td> </tr> <tr> <td>33-39</td> <td>63</td> <td>25</td> </tr> <tr> <td>40 and over</td> <td>65</td> <td>18</td> </tr> </tbody> </table> <ul style="list-style-type: none"> - History of disease = best indicator that a disease may be present. - Orthodontic appliances make oral hygiene more difficult. 	Age Group	Pocketing > 5 mm (%)	Inadequate attached gingiva (%)	Under 10	5	7	10-19	17	27	20-26	32	38	27-32	48	28	33-39	63	25	40 and over	65	18
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Characteristics of periodontal disease	<ul style="list-style-type: none"> - Degenerative process ≠ Ø continues, Ø progressive. - Episodes of acute attacks on some, but usually not all areas of the mouth, followed by quiet periods. - 3 groups of progression of periodontal bone loss: <ul style="list-style-type: none"> • Rapid: 10% • Moderate: 80% • No progression: 10% - <i>Prof. Salvi:</i> <ul style="list-style-type: none"> Risk factors for periodontitis continuation / relapse: <ul style="list-style-type: none"> • Restpockets > 6mm • BOP > 25% • Furcation involvement > 3mm (= grade 2 & 3) Characteristics for periodontal doubtful teeth: <ul style="list-style-type: none"> • Furcation involvement grade 2 & 3 • Angular (=vertical) defects • Horizontal bone loss ≥ 2/3 of the root length - If the disease is under control, there is no contraindication for orthodontic tx. - Space closure in areas with major bone loss sometimes leads to an improvement in bone height if at least one wall of the periodontal pocket is remained. - Bacteria = Main etiologic factor. Genetic disposition in some cases. → The effect is determined by the host response. - <i>Seminar ZMK:</i> <ul style="list-style-type: none"> <u>Resistance of the biofilm:</u> <ul style="list-style-type: none"> • Quorum sensing: Interchange of signals, toxins, metabolites... • Interchange of genes • Production of bacteriocins • Extracellular matrix formation <u>Main pathogenic bacteria:</u> <ul style="list-style-type: none"> • Aggregatibacter actinomycetemcomitans = A.a. • Porphyromonas gingivalis = P. gingivalis • Treponema denticola • Tannerella forsythia 																					

Diagnosis	<ul style="list-style-type: none"> - BOP - Evaluation of subgingival plaque and crevicular fluids for the presence of indicator bacteria / enzymes / chemical mediators. - Examine the level and condition of the attached gingiva: - Width. (not all keratinized gingiva is attached) - Thickness. - <i>Prof. Sculean:</i> <ul style="list-style-type: none"> • Gingivadieke ist wichtiger als Breite um Rezessionen zu vermeiden. • Biotype: Defined by genetics <ul style="list-style-type: none"> ◦ Thin scalloped 12-81% ◦ Thick scalloped ◦ Thick flat <p>→ Transplant of keratinized gingiva into mobile mucosa remains stable.</p> • Phenotype: Defined by local factors. • Positive Korrelation zwischen: <ul style="list-style-type: none"> ◦ Gingiva Dicke. ◦ Keratinisiertes Gewebe. ◦ Knochenmorphologie Typ.
Recessions	<ul style="list-style-type: none"> - Labial movement of incisors can be followed by gingival recessions and loss of attachment in some patients. - Greatest risk if irregular teeth are aligned by expanding the dental arch. - Prof. Salvi: <ul style="list-style-type: none"> • The thickness of the gingiva is more important than the width. • Risk for recession formation: <ul style="list-style-type: none"> ◦ Thin biotype. ◦ Insufficient width of the keratinized gingiva. ◦ Inflammation. ◦ Recession before orthodontic tx. - Present concept <ol style="list-style-type: none"> 1. Stress of the tissue: Toothbrush trauma, plaque-induced inflammations, stretching / thinning of the gingiva created by labial tooth movement. 2. Alveolar bone dehiscence → Leads secondary to recessions. - Once recessions begin, rapid progression is possible esp. if little or no keratinized attached gingiva exists. - Prevention of recessions is better than correction later: → Consider a gingival graft for patients with minimal attached gingiva or thin tissue esp. if arch expansion, surgical mn advancement or genioplasty is planned.
Tx of patients with minimal periodontal involvement	<ul style="list-style-type: none"> - Plaque control. - Examination of the gingiva. - Simple appliances. - SS-Lig. instead of plastic moduls. - SS-bracket instead of ceramic or composite brackets. - Ø difference self-ligating vs. conventional ligating brackets. (Evidence is controversial) - Consider skeletal anchorage (reduced anchorage from the teeth) - Permanent retention. - Best gingival index values: Invisalign > lingual appliances > labial appliances.
Tx of patients with moderate periodontal involvement	<ul style="list-style-type: none"> - Remove all calculus prior to orthodontic tx, incl. flaps if necessary. - Not clear at the moment if a bone graft as part of a corticotomy is indicated to prevent bone dehiscence and gingival recessions when a significant arch expansion is planned. - Defer osseous recontouring or reposition flaps to compensate for gingival recessions until the final occlusal relationship has been established. - Period of observation after the completion of periodontal tx: (Note: Delay of min. 3 months / longer if periodontal surgery was performed) Allow healing of the tissues and make sure that the disease is under control. - Pulpal involved teeth: <ul style="list-style-type: none"> • Endodontic tx prior to orthodontic tx. • Movement of pulpal involved teeth can cause a flare-up of pulpitis and pain. - Caries should be treated with composite resins. Cast restorations should be delayed until the final occlusal relationships have been established with orthodontic tx. - Use fully bonded orthodontic appliance: The margin of bands can make periodontal maintenance more difficult. - Use self-ligating brackets or steel ligatures:

	<p>→ Elastomeric rings have higher levels or microorganisms in gingival plaque.</p> <ul style="list-style-type: none"> - Continue periodontal maintenance therapy at 2-4 m intervals. - Consider adjunctive chemical agents between periodontal controls (incl. CHX if needed) - <i>Ghijssels, 2014:</i> Placement of fixed appliances has an impact on periodontal parameters. Shift to a more anaerobic bacterial flora. Not all parameters are normalized 2 years post-tx, indicating that the changes are only partially reversible.
Tx of patients with severe periodontal involvement	<ul style="list-style-type: none"> - Same principles like for patients with minimal / moderate periodontal involvement. - Schedule periodontal maintenance at more frequent intervals: 4-6 w. - Keep orthodontic forces to an absolute minimum: <ul style="list-style-type: none"> • Reduced area of the PDL after sign. bone loss means higher pressure in the PDL from any force. • Moments created by forces applied to the crown are larger with the center of resistance moving apically. • Less anchorage available.  <p>The diagrams illustrate the relationship between force application, center of resistance, and the resulting pressure and moments on the periodontal ligament (PDL). In the first diagram, a 100 gm force is applied at 10 mm from the center of resistance, creating balanced pressure and moments. In the second diagram, the same 100 gm force is applied at 15 mm from the center of resistance, creating unbalanced pressure and moments. In the third diagram, a 50 gm force is applied at 15 mm from the center of resistance, creating balanced pressure and moments.</p> <ul style="list-style-type: none"> - Hopelessly involved periodontal teeth can be used to support an orthodontic appliance that contributes to save other teeth. - Crown-root length ratio is an important factor for the long-term prognosis (min. 1:1). <ul style="list-style-type: none"> → Shortening of the crown is often indicated instead of intrusion in adults with bone loss if the aesthetics allow it (mn yes, mx rather no to avoid reduction of the tooth display).

Comprehensive treatment in adults: Prosthodontics-implant interactions	
Reasons for need of orthodontic tx	<ul style="list-style-type: none"> Loss of tooth structure from wear / abrasions or trauma Gingival esthetic problems Missing teeth
Problems related to loss of tooth structure	<ul style="list-style-type: none"> The final position of the teeth which are going to be moved must be discussed with the prosthodontist. Orthodontic positioning must provide adequate space for the appropriate addition of the restorative material. <ul style="list-style-type: none"> Total amount of space which should be generated. Mesio-distal and bucco-lingual position within the space. Vertical positioning. Better reconstructions can be done if slightly more space than required for the restorations is available (for finishing & polishing of proximal surfaces). → A slight excess of space can be closed with a retainer. <u>Define in advance what is the reference for leveling:</u> <ul style="list-style-type: none"> Incisal edges and marginal ridges. Gingival margins and contours. Bone levels. <u>For small amounts of lost tooth structure:</u> <ul style="list-style-type: none"> Smooth the fractured area and elongate the damaged tooth so that the incisal edges line up. Cave: Uneven gingival margins. Maximum 1-2 mm elongation unless the patient never exposes gingiva.
Gingival esthetic problems	<ul style="list-style-type: none"> 2 categories: <ol style="list-style-type: none"> Excessive and/or uneven display of gingiva. Gingival recessions after bone loss. Maintaining an even gingival margin in the mx incisor area is esp. important for patients with a high smile line. → Important for tx choice if one lateral incisor is missing. Extruding worn or fractured teeth can create an unaesthetic gummy smile. Mesialisation of a canine in case of unilateral agenesis can lead to uneven gingival margins. IPR is indicated for black triangles to move the contact point more gingival and minimize the open space between teeth.
Missing teeth: Space closure vs. prosthetic replacement	<ul style="list-style-type: none"> <u>Old extraction sites:</u> <ul style="list-style-type: none"> Space closure is difficult: <ul style="list-style-type: none"> Decrease in vertical bone height due to resorption. Narrowing of the alveolar process in the bucco-lingual dimension due to remodeling. → Reshaping of the cortical bone that comprises the buccal and lingual plates of the alveolar process is necessary. Cortical bone responds normally to orthodontic force, but the response is sign. lower. <u>Moving lower molars forward into old premolar extraction spaces:</u> <ul style="list-style-type: none"> Temporary implants in the ramus can be used for anchorage to prevent retracting the incisors. Cortical bone remodeling is usually required. Space closure is likely to be slow. Often it is better judgement to open a partially closed old extraction site and replace the missing tooth.
Tooth loss due to periodontal disease	<ul style="list-style-type: none"> If one bony wall remains, space closure can result in an improvement of the periodontal situation. → In most other cases (= no bony wall remains), a tooth should be moved away from such areas and prosthetic restorations are preferred. Normal bone formation cannot be expected when a tooth is moved into a defect. Exception: Aggressive juvenile periodontitis in adolescents. <u>Aggressive juvenile periodontitis in adolescents.</u> <ul style="list-style-type: none"> Once the disease is under control (needs antibiotics), the causative agent (<i>Actinobacillus actinomycetemcomitans</i>) seems to disappear. Orthodontic space closure of a missing incisor is rarely feasible.

	<ul style="list-style-type: none"> • 2nd molars can be moved into the extraction site of the first molar and bring their investing bone with them → large bony defects disappear. • Factors to predict success: <ul style="list-style-type: none"> ◦ Young patients. ◦ The original attack was almost entirely on the 1st molars. ◦ Change in the bacterial flora.
Comprehensive orthodontics in patients planned for implant therapy	<ul style="list-style-type: none"> - Go ahead with grafts in further implant areas, while the orthodontic tx is carried out. → The patient is ready for implants as soon as the orthodontic appliance is removed. - Implant surgery can maybe carried out before the whole orthodontic tx is finished. → An osseointegration period during orthodontic tx is advantageous. - Fixed orthodontic retainer = Best choice to maintain the space for a later implant. - <u>Damaged and ankylosed maxillary incisors or canines:</u> <ul style="list-style-type: none"> • Can interfere with orthodontic tx to align the other teeth. • Alveolar atrophy occurs, if the tooth is extracted before the vertical growth is completed. • Remove the crown of the offending tooth, but remain the endodontically treated root (or do a (Ca(OH)₂ filling) to “bank” the alveolar bone. → Better chance for successful implant placement without a bone graft. • Pontic tied to an archwire or resin-bonded bridge as a temporary provisory. • Too early placed implants are equivalent to an ankylosed tooth: → Intrusion occurs as the vertical development continues and the other teeth erupt (same problem later) as slow vertical growth continues into middle age.

Comprehensive treatment in adults: Complex treatment procedures	
Lingual orthodontics	<ul style="list-style-type: none"> - Characteristics of lingual appliances: <ul style="list-style-type: none"> • Custom-formed pad for each tooth to provide more secure bonding of the appliance. • Low-profile brackets printed from a new proprietary alloy with bracket slots that are much more precise than those of edgewise brackets. • Wire bending robots. - Shorter span of the archwire between the attachments lingual than buccal. → Stiffness of the material ↑ - All wires including A-NiTi preshaped, as lingual surfaces of the teeth do not line up as well as the facial facets. - Grauer, 2011: Incognito: Precise reproduction of the tx goal of tooth positions within <1 mm or 5° of inclination. Except 2nd molars which are less accurately.
Clear aligners	<ul style="list-style-type: none"> - Possible to treat complex malocclusion nowadays, given that: <ul style="list-style-type: none"> • Bonded attachments are used. • The amount of change between the aligners is reduced. • Some phases of complex tx are provided with fixed appliances. • New records and a new set of revision aligners is often needed during the tx process. • If the amount of tooth movement and tx steps increases, it is better to set an intermediate goal and from there complete the tx. - <u>Overcorrection aligners:</u> <ul style="list-style-type: none"> • Produced by virtual shrinkage of the teeth. → Virtual creation of spaces, which are closed. • Don't use them if no spaces are present after the ordinary aligners.
Applications of skeletal anchorage	<ul style="list-style-type: none"> - Indications: <ul style="list-style-type: none"> • Positioning individual teeth when no other satisfactory anchorage is available. (loss of teeth) • Retraction of protruding incisors. • Distal or mesial movement of molars (or the entire dental arch). • Intrusion of posterior teeth to close an anterior open bite or intrusion of anterior teeth to open a deep bite.
1. Retraction of protruding incisors	<ul style="list-style-type: none"> - Maxilla: <ul style="list-style-type: none"> • Stabilization away from the midline is better than an implant in the center of the palate. • <u>Retraction of single / multiple teeth:</u> Palatal bone screws. • <u>Retraction of the whole arch:</u> Miniplates below the zygomatic arch or palatal bone screws. - Mandible: <ul style="list-style-type: none"> • Alveolar bone screws in the buccal shelf below the molars are recommended for retraction of anterior teeth or the entire mn arch. • Narrow basal bone in the anterior part usually contraindicates torque application during incisor retraction, because of risk for root resorptions. • In Asian adults with significant retraction of incisors, bony spicules sometimes appear between the roots of the teeth. They are created by differential remodeling of alveolar bone as the teeth are moved posteriorly. The bone immediately adjacent to the tooth remodels the same distance as the tooth moves. In affected patients, bone between and over the teeth remodels less and this creates the irregular bony protrusion. The genesis and why Asian people and from this population only a minority is concerned, remains unclear.



2. Retraction and intrusion of protruding incisors	<ul style="list-style-type: none"> - Possible with segmented arch mechanics. - Skeletal anchorage is recommended: With screws between the molar roots or miniplates the required upward and backward force can be achieved. - More difficult than simple retraction of the incisors. - Use A-NiTi springs: = Constant force levels.
3. Distal movement of molars or the entire dental arch	<ul style="list-style-type: none"> - Maxilla: <ul style="list-style-type: none"> • Miniplates / screws in the palate or infrzygomatic process are better than interradicular screws for a predictable outcome. → Roots can be moved without interference from the screws. • The entire arch can be moved 2-4 mm in distal direction (more with extractions). • Extractions of 2nd molars or premolars are maybe necessary. - Mandible: <ul style="list-style-type: none"> • Long bone screws in the mandibular buccal shelf (preferred) or alternatively in the ramus. • Indications for distalization: <ul style="list-style-type: none"> ○ Class III malocclusion with a component of mandibular dental protraction. ○ Incisor protraction created during tx of severe crowding.
4. Molar protraction	<ul style="list-style-type: none"> - Maxilla: Direct anchorage, using a power arm from the molar so that the force direction is near the center of resistance. - Mandible: Short vestibule → Indirect anchorage using the screw wired to an anchor tooth is preferred.
5. Incisor intrusion	<ul style="list-style-type: none"> - Use segmented rather than continuous archwires. - Deepening of periodontal pockets might be produced by tx. Intrusion does not lead to reattachment of periodontal tissues. → Formation of a tight epithelial cuff, so that the position of the gingiva in relation to the crown improves clinically, while periodontal probing depths do not increase. - Bone levels tend to follow the amount of intrusion. - No great affection of root resorption and alveolar bone height. - Alternative approach to intrusion: <ul style="list-style-type: none"> • Remove part of the crown from elongated incisors if the periodontal prognosis (root-crown ratio) is improved and orthodontics facilitated. • Rather used in the mandible than the maxilla (incisor display). - Seminar ZMK: Intrusion of periodontal involved teeth: <ul style="list-style-type: none"> • Ø reattachment of the PDL. • Ø additional attachment win. • Formation of a long junctional epithelium (langes Saumepithel). • The bone follows the intrusion. → Better position of the gingiva to the crown, probing depths do not increase.
6. Intrusion of maxillary posterior teeth to close an anterior open bite	<ul style="list-style-type: none"> - Anchorage: <ul style="list-style-type: none"> • Miniplates • Long bone screws extending into the base of the zygomatic arch. <ul style="list-style-type: none"> ○ Between 1st / 2nd molar if distalization of the dental arch will maybe necessary. ○ Between the 1st molar and 2nd premolar if mesialization of the dental arch will maybe necessary. • Palatal screws: no studies, but should also be effective. - Control facially tipping force during intrusion → A bonded plate covering the occlusal surface of the teeth and fabricated with some distance to the palate can be used.

