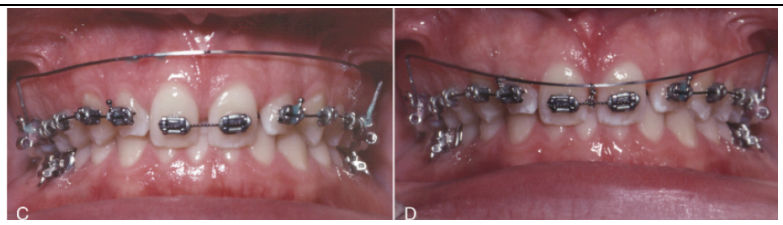
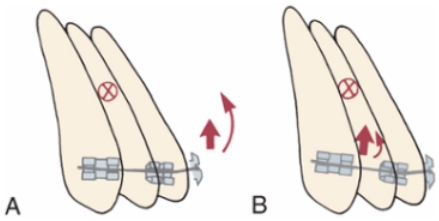


- <u>Forward movement of the incisors must be prevented:</u>
  - Tip back the auxiliary arch against the posterior segments to create a space closing force.
    → Cave: Strain on the posterior anchorage in mesial direction.
  - Vary the point of force application against the incisor segment in relation to the center of resistance of the whole segment.
    - Tying the depressing arch distal to the midline between the central and lateral incisors or distal to the laterals.
    - The point of force appliance is more posterior and the force closer applied through the center of resistance.



A) When the incisor segment is viewed from a lateral perspective, the center of resistance (X) is lingual to the point at which an archwire attaches to the teeth. For this reason, the incisors tend to tip forward when an intrusive force is placed at the central incisor brackets. (B) Tying an intrusion arch distal to the midline (for instance, between the lateral incisor and canine, as shown here) moves the line of force more posteriorly and therefore closer to the center of resistance. This diminishes or eliminates the moment that causes facial tipping of the teeth as they intrude.

- Cave:
  Extrusion & distal tipping of the posterior segment as reaction to the incisor intrusion.
- Intrusion / extrusion rate of 4:1 can be achieved.

- Asymmetric intrusion possible:
  - <u>Asymmetric activation of the intrusion arch</u>:
    Tie the auxiliary arch at the point where intrusion is desired + adjust the teeth in the stabilizing segment.
  - <u>Cantilever auxiliary</u> wire from one molar.

3. Aligners	- Attachments on the posterior teeth avoid that the aligners slide down posteriorly when an upward force is placed on the anterior teeth
4. Skeletal anchors	- Eliminate the problem of unwanted movement of the anchorage teeth. - Necessary for intrusion of posterior teeth to correct a tipped palatal plane. - - Miniscrews / miniplates: • The amount of force which can be placed against a bone screw is well within the force magnitude needed for tooth movements. • Make tx more effective.
Discussion	- Levelling mesial in rotated 1st molars: Archwires lies buccal to the 2nd molars. → Buccal tilting + bite opening effect when 2nd molars are leveled.

Proffit Chapter 16:

Comprehensive Treatment in Adolescence:

Space closure and Class II / Class III Correction.

Class II correction in adolescents

- 2 possibilities without surgery:
  1. Differential growth of the jaws guided by EO force or a functional appliance.
  2. Differential anteroposterior movement of the upper and lower teeth with or without differential closure of extraction spaces.

- A combination of both approaches is possible. Even successful growth modifications typically provides only a partial correction of a full class II/III malocclusion.
  → Some tooth movement is almost always needed to correct the molar relationship.

1. Differential growth in adolescent class II tx

- Forward growth during adolescence: Mandible > maxilla.
- Gender differences:
  Boys are with 13 y at the same stage of maturation as girls with 11 y of age.
  - Girls: Peak of growth spurt often before the full dentition is present.
  - Boys: Clinical useful rest of growth in the early mixed dentition.
- A functional appliance can be used in immature patients with a permanent dentition before a fixed appliance is inserted for the correction of the occlusal details.
  Cave: The functional appliance has to be modified or discontinued when the fixed appliance tx starts.
- Intermaxillary elastics or flexible spring devices:
  Growth modification seems unlikely in adolescents.
- HG:
  - Compatible with fixed appliance tx.
  - Space development is unusual between 6/5+5/6. 54+45 follow the molars. → Space opens distal the canines.
- Herbst appliance:
  Rarely space opening within the mx arch in the early permanent dentition.

2. Class II correction by distal movement of upper molars

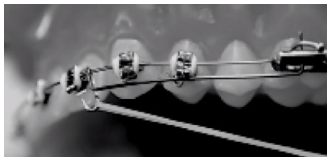
- Limits:
  Sign. distal positioning of the upper posterior teeth in relation to the mx occurs primary in patients with vertical growth and elongation of the maxillary teeth:
  The molars and premolars are tipped distally during eruption.
  Otherwise hardly > 2-3 mm distal movement of 6+6 (4-6 mm with TADs) can be achieved except 7+7 are extracted
- Correction of mp rotated 6+6 provides a small space mesial.
  Note: Wire lies buccal to the 2nd molars → buccal tipping → extrusion due to tipping.

- A-NiTi coil spring compressed against the molars (from an anterior anchorage unit) can produce an effect and a nearly constant force system for distal movement.

- Magnets in repulsion can be used.
  → Cave: Force amount changes as tooth movement occurs.

- HG:
  - High force with relatively limited duration.
  - > 2 mm movement of 6+6 is only achieved when they are simultaneously elongated. (allowed only in good vertical growers)
  - Highpull HG is not very efficient for distalizing molars.

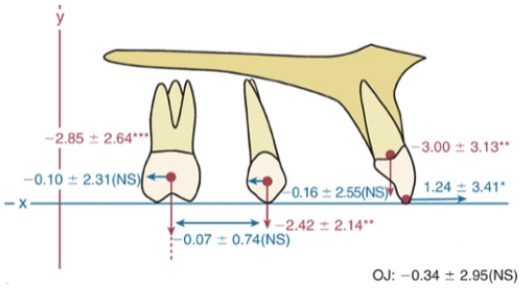
- Cl.II elastics:
  - Can be applied to a sliding jig to concentrate the force to the molars (mainstain of the original Tweed technique).




- Risk of mesial movement mn teeth > distal movement mx teeth.
- Elongation of mx & mn teeth.

- Palatal anchorage:
  - Removable appliances (Nance, Pendulum) contacting the palate are not effective in molar distalization → fit is may not good enough.
  - Mainly prevents tipping and mesial in rotation of the premolars.
  - Contact on the palate can cause tissue irritations.

  - Pendulum is successful to push the molars back to gain space, but the space is lost during later space closure. (*Byloff, 1997*)
    - Beta-titanium wire 200-250 gm force.
    - Molar movement on average 1 mm/m.
    - Side-effects: Distal tipping of the crown and elongation of the molars. Premolars / incisors tip anteriorly.
    - Leave distalization appliance 2-3 m in place after the distal movement of 6+6:
      → Premolars are moved back by the stretch of the gingival fibers.
    - Tip forward bend in the wire during distalization:
      → Tipping of the molar ↓, distal movement of the roots ↑
      BUT displacement of the incisors ↑, tx time↑.

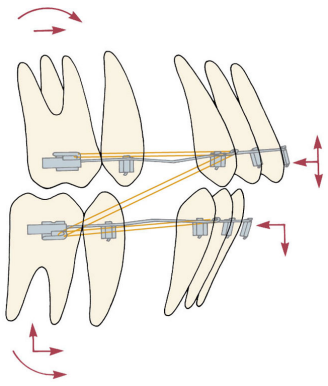


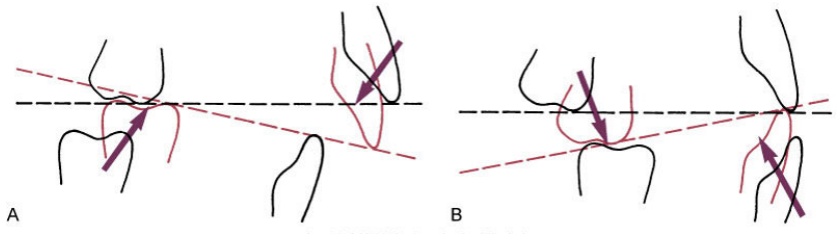
Mean changes in tooth position relative to the maxilla in a sample of 35 Class II patients treated with a first phase of pendulum appliance molar distalization followed by comprehensive fixed appliance treatment, with a mean treatment duration of 3.1 ± 0.6 years. Note the small average net distalization of the molars relative to the maxilla. In the final analysis, successful correction of the Class II malocclusion was due more to jaw growth, transverse expansion of the dental arches, and forward movement of the lower incisors than to distalization of upper molars.

- Miniplate anchorage:
  - Works well as direct or indirect anchorage to move the whole arch or a single unit of posterior teeth back.
  - All the maxillary teeth can be moved back simultaneously.

- Alveolar bone screws:
  - If alveolar bone screws are placed between the roots:
    Mesio-distal movement of the teeth is blocked:
    → Screws must be repositioned during space closure.
  - Risk of screw failure.

- Palatal bone screw anchorage:
  - Indirect anchorage from this area is the most efficient way to move molars distal and hold them there while the other teeth are retracted into this area.
  - Expansion will be needed if molars are distalized.
  - Intrusion would be expected, because the anchor is in the depth of the palate.
  - Extraction of 7+7 or 8+8 is maybe necessary to prevent impaction or difficult extractions.
    → 8+8 normally erupt well in the extraction space of 7+7 and bring bone with them.
    Moffitt, 1998: 75-80% chance that 8+8 satisfactorily replace 7+7.
  - Very effective, so that overretraction of the upper incisors is possible.

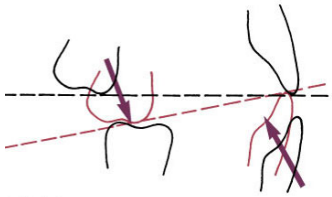
3. Differential anteroposterior tooth movement using extraction spaces	- Extraction space needed for alignment ↑ = Extraction space for differential movement in camouflage ↓
- A: Distalization of 6+6 after ex 7+7	- 4-5 mm short-term distal movement of 6+6 expected with ex 7+7, however a big part is likely to be lost in long-term. - Greater distalization of 6,5+5,6 possible with skeletal anchorage when 7+7 are extracted. - *Moffitt, 1998:* 75-80% chance that 8+8 satisfactorily replace 7+7.
- B: Class II camouflage by extraction of 4+4	- Camouflage = Correcting the malocclusion if the facial appearance is acceptable without treating the skeletal jaw discrepancy. - Goal: Maintain class II molar relationship and lose the extraction space by retracting protruding incisors. - Anchorage: • EO force on 6+6 + stabilizing lingual arch → Lingual arch: ○ Prevent mesial-lingual rotation of 6+6 around the palatal root. ○ Prevent mesial tipping of 6+6. ○ A lingual arch with a button against the palatal tissue is not more effective than a straight transpalatal lingual arch to stabilize 1st molars in a premolar extraction case. • Skeletal anchorage necessary to retract the mx anterior segment. • Cl.II elastics are contraindicated unless the lower teeth should be moved forward. - No evidence that TMJ problems are provoked (was a claim in the past). - Consider facial appearance when moving maxillary teeth back. - If the malocclusion is due to a mn deficit, retracting the maxillary incisors also creates a maxillary deformity. Don't do! - J-hook headgear: (HG attached to the archwire) ○ Pro: No strain on the posterior teeth. ○ Contra: Interruptive force, sign. binding and friction. → Often leads to asymmetric space closure.
- C: Extraction of maxillary and mandibular premolars	- <u>Ex 4±4:</u> • Mn posterior segments must be moved anteriorly nearly the whole width of the extraction space. Mx anterior teeth must be retracted without forward movement of the mx buccal segment. → Use of class II elastics indicated. • Edgewise appliance: ○ Crown tipping for space closure is difficult with the width of the bracket. ○ A segmental arch approach is preferred. • Begg approach: Space closure by tipping the crowns. - Add light intraarch elastics to help space closing at the beginning while class II elastics are continued. - Use light force = optimum force levels for tipping, while force for bodily movement should remain suboptimal. - Anchor bends to counteract tipping: ○ → Maxilla: Anterior teeth tend to tip backward. ○ → Mandible: Control of mesial tipping of the molars.  Forces encountered in the second stage of Begg treatment, in which base archwires (grey) with anchor bends are combined with intra-arch and Class II elastics (orange). The anchor bends produce bodily forward movement of the molars, but no couples are present on the incisors, so these teeth tip lingually. The anchor bends also depress the incisors and elongate the molars, which is counteracted by the Class II elastics for the upper arch but accentuated by the elastics for the lower.

	- <u>Ex 4+4, 5-5</u> • 6-6 will be moved more mesially than 6+6, because of the different anchorage value of the units. • Mesial movement of a 6-6 is difficult if 5-5 are congenitally missing. Extraction V-V: First only the distal root + $Ca(OH)^2$ pulpotomy and temporary restoration, because bone resorption reduces the alveolar ridge dimension before space closure can be completed.
4. Nonextraction correction with interarch elastics	- Cases without extraction-spaces: Molar correction largely by mesial movement of the mn arch and only a small amount of distal positioning of the mx arch. Cave: Class II patients have the lower teeth almost always normally positioned or proclined → too much protrusion of the lower incisors → relapse likely. (Soft tissues allow max. 2 mm incisor protrusion, afterwards there is a sharp increase in force) - **250 gm per side** needed to displace one arch relatively to the other with a rectangular wire in the lower arch. Less force if a lighter round wire in the lower arch is placed. - Incorporate 7-7 in the appliance and hook elastics to 7-7: → More horizontal direction of the pull. - Cave: Always a vertical force! Occlusal plan rotates posterior up and anterior down (molar extrusion > vertical growth) → Cl.II elastics contraindicated in non-growing patients who cannot tolerate downward-backward rotation of the mandible  *Rotation of the occlusal plane with Class II **(A)** and Class III **(B)** elastics.* - A good short-term effect in the occlusal relationship can maybe be achieved with cl.II elastics, but they are less satisfactory considering skeletal relationship and dental esthetics. → Not indicated for a major cl.II correction, but acceptable to install a good posterior interdigitation at the completion of tx.

Class III camouflage

- = Procline maxillary incisors and retract mandibular incisors into an extraction space.
  → Cave: Makes the chin more prominent.

- Indications:
  - If the reversed OJ is largely due to protrusive mandibular incisors and retrusive maxillary incisors.
  - More maxillary deficiency than mandibular prognathisme.

Cl.III elastics	- Extrusive component → Downward-backward rotation of the mn helps cl.III correction for patients with a short anterior face height. 
Extraction 4-4, 5+5	- Retraction of the lower incisors makes the chin more prominent. → Acceptable in Asian people who often have dental protrusion, but normally not for Caucasians.
Extraction of mn premolars	- Can be successful, if the lower incisor retraction is carefully controlled.
Extraction of one lower incisor	- Good approach for Caucasian patients. - Prevents major retraction of the lower teeth, while the mx incisors are moved facially with some tipping. - Upright mandibular incisors with proclined mx incisors often end in good dental occlusion rather than expected tooth-size problems. - A primary setup is mandatory.
Lower arch distalization	- Skeletal anchorage allows to move the whole lower arch distal. - Indicated if the lower incisors are severely protruded. - Extraction of 8-8 is maybe needed in case of extensive distalization. - If 7-7 are extracted to improve distalization, 8-8 normally do not erupt as satisfactory replacement like in the mx → not recommended to perform routinely.
Asian patients	- Often have dental protrusion → retraction of lower incisor and downward and backward rotation of the mn is better tolerated than for Caucasians.

Space closure in incisor protrusion problems: Sliding versus loop mechanics in space closure

- A force to move the teeth + a root-paralleling moment to move achieve bodily movement is necessary for space closure.

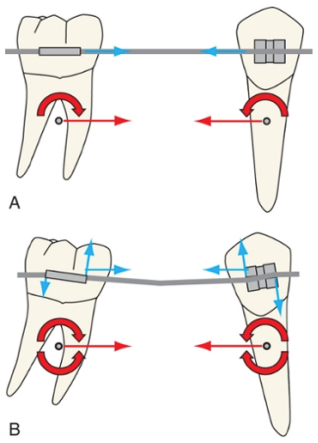
TABLE 16.1 Sliding Versus Loop Mechanics

Method	Sliding teeth on an archwire	Closing loop between segments
Generation of force	Alastic or NiTi spring to single tooth or group of teeth	Activate the loop
Net force desired	100gm per tooth	150gm per segment
Resistance to sliding	Approximately 100gm per tooth	None
Generation of moment	Automatic (bracket width)	Gable bend, approximately 45 degrees

NiTi, Nickel–titanium.

1. Sliding mechanics

- The wire must be undersized relative to the bracket and strong enough not to bend sign. when force is applied across the section that spans across the extraction site.
- Contact between wire and bracket closer → friction ↑
- **0.03 inch = 0.5 mm** difference between bracket slot and wire is enough to largely avoid friction.
    - Most brackets are slightly larger than the nominal size.
    - Most wires are slightly smaller than the nominal size.
- An uprighting moment is generated in the bracket when the tooth begins to tip and contacts the corners of the bracket.
    → Uprighting if the wire does not bend.
    → Tipping if the wire bends.



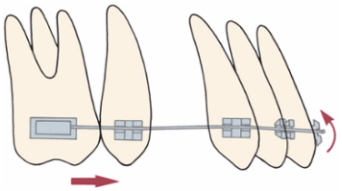
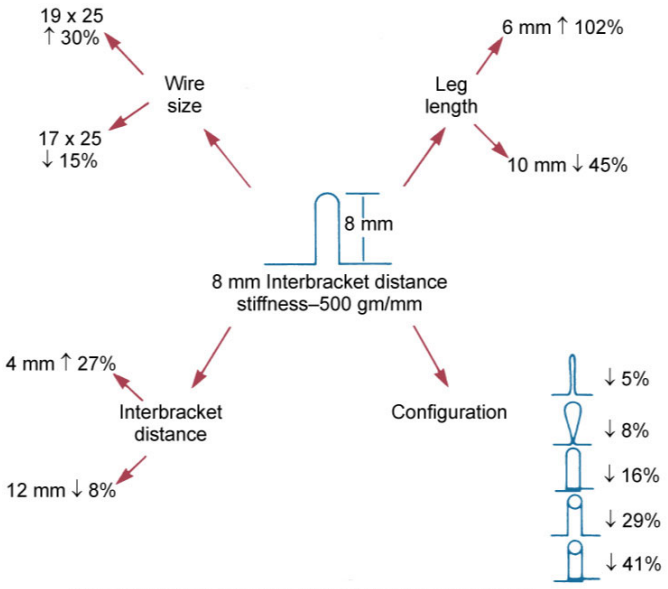
A, When a retraction force is placed on the brackets *(blue arrows),* the center of resistance feels both a translational force and the moment of a force that initially causes tipping *(red arrows).*
B, As the teeth tip, the wire engages at opposite edges of the bracket, creating a couple that resists tipping. After a certain level of tipping occurs, the moment of the couple and the moment of a force are in equilibrium and no further tipping occurs. This equilibrium point depends on the retraction force, wire stiffness, interbracket span, and bracket width.

- **Bracket width ↑ → binding forces ↓**
  Ideal bracket width = ½ width of the teeth. (larger = alignment impeded)

- **Arm of the uprighting moment = ½ bracket width**

- Mechanisms to generate force:
    - NiTi coil springs: ideal
        - Pro: Force known and constant.
    - Elastics chains:
        - Contra: Quick force decay.
        - Pro: Easier placement, oral hygiene easier?

- Sliding = fail safe mechanism.

	- Torque of the incisors if often needed during retraction. Cave: Reciprocal mesial directed force on the molars (advantageous in cl.III patients). 
2. Closing loop mechanics	- Use rectangular wires to prevent the wire from rolling in the bracket slot. - Frictionless: → Potential to reduce anchorage problems and reduce time for space closure. - Factors influencing the spring characteristics: ○ **Spring properties**: = Amount of force delivered and how the force changes as the teeth move ○ **Moments generated to control the root position.** ○ **The location of the spring relative to adjacent brackets** = The extent to which it serves as a symmetric or asymmetric bend in the archwire. - <u>Properties of closing loops determined by:</u> ○ **Wire material:** SS or TMA recommended, TMA exerts always about ½ force of ss. ○ **Wire size:** Largest changes in characteristics. ○ **Distance between the points of attachment:** Affected by the amount of wire incorporated into the loop and the distance between the brackets. ○ **Center of the apical portion of the loop:** Regardless of the position of the loop legs. → Closing loops with similar properties can be produced from different wire materials and different wire sizes. → Simpler loop designs are possible with wires of greater inherent springiness or smaller cross-sectional areas. *Booth, 1971* "The effects on force of changing various aspects of a closing loop in the archwire"  - <u>Root-paralleling moments:</u> • The requirement to generate a moment limits the amount of wire that can be incorporated into a closing loop to make it springier. Loop to flexible → no moments generated. • Placing some of the wire in the closing loop in a horizontal rather than a vertical direction improves the ability to deliver the moments needed to prevent tipping.

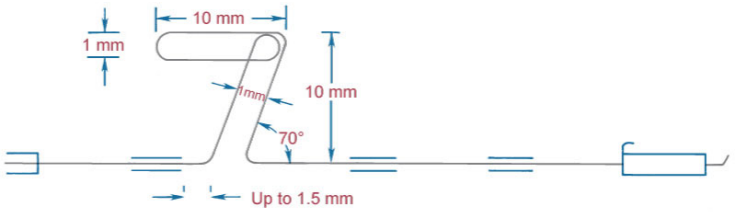
→ Ideal: Closing loop 7-8 mm tall while incorporating 10-12 mm wire.
(no impinging on soft tissue)

- Opening the parallel legs of a loop generates moments in the desired direction, but they are too small (unless the loop is not unacceptable tall)
  → Additional root-paralleling moments must be created by gable bends.

- <u>Location of the loop:</u>
  - Closing loops function as a V-bend:
    - Loop placed in the center of a span (geometrie VI):
      → Equal forces and couples on the adjacent teeth.
    - One third of the way between adjacent brackets (geometrie IV):
      → Tooth closer to the loop extrudes & feels a moment to bring the root toward the V-bend.
    - V-bend closer to one bracket than $^1/_3$ (geometrie I/II/III):
      → The more distant tooth will not be intruded but receives a moment to move the root away from the V-bend.
  - Preferred location = spot which will be the center of the embrasure when the space is closed.
    e.g. 5 mm distal to the center of the canine tooth in case of extraction 4+4.

- <u>Additional design principles:</u>
  - Loops should be “fail safe”:
    Tooth movement should stop after a prescribed range of movement (1 mm per month). Not more than 2 mm range.
  - Keep the design as simple as possible:
    → More comfortable for patients, easier to fabricate clinically, less risk for breakage / distortion, but maybe less efficient.

    → **Opus loop:**
    Optimum and nearly constant moment-to-force ratio at variable activations.
    Produced from wires 16x22 / 18x25 SS or 17x25 TMA.
    Cave: Clinical complex, risk for distortion by the patient.



  - <u>Activation modus:</u>
    - A loop is more active, when it is closed rather than opened during its activation (Sicherheitsnadel-Prinzip).
    - Loops designed to be opened during activation:
      → Vertical legs in contact when it closes completely preventing further movement = fail safe effect.
    - Loops activated by closing:
      Vertical legs overlap → Creation of a transverse step.
      The archwire does not develop the same rigidity when it is deactivated.
      (important esp. for smaller and flexible wires)

Correction of bimaxillary protrusion

- Usually 4±4 are extracted.
- The clinical management depends of how much incisor retraction is needed.

Moderate anchorage situations:

Lückenschluss B (reziprok)

Space closure with the **22-slot edgewise**

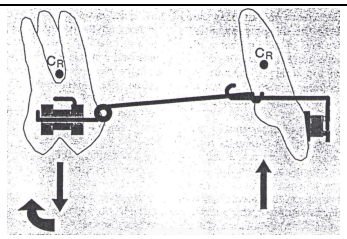
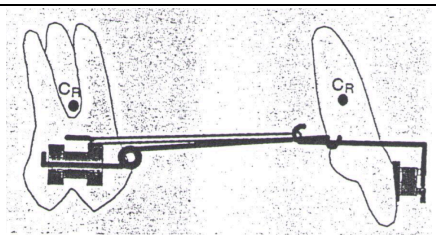
- 2 step space closure: Divide the space closure into 2 steps:
  1. Retract the canines (sliding along the archwire).
  2. Retract the 4 incisors (closing loop).
- Failsafe.
- Takes longer to close the spaces than one step space closure.

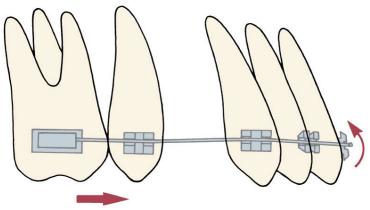
- 1st step:
  - 19x25 ss wire = Largest on which sliding retraction of a canine should be attempted (minimum 0.03 mil clearance in the bracket slot needed).
  - Posterior stop usually in front of the first molar tube needed.
  - Canine retraction with:
    - A coil spring:
      → A-NiTi coils springs preferred: Almost ideal light constant force.
    - An elastomeric material.
    - A spring soldered to the base archwire.

  - Sliding space closure is fail safe:
    - Moments necessary for root paralleling are generated automatically by the twin brackets:
      → No danger that teeth will tip excessively.
    - Rigid attachment of the canine to the continuous ideal archwire removes the danger that this tooth will be moved far outside the intended path.
      → A long range of action for the retraction spring can be used, as long as the force is not excessive (ideal 150-200 gm).

- 2nd stage:
  - Mandible: Continue with sliding or a closing loop.
  - Maxilla: Closing loops are preferred when a greater incisor torque is needed. (most often the case)
    - **60:40** (60% anterior retraction, 40% posterior protraction) closure of the extraction space can be expected, depending if 7+7 are included in the anchorage and the amount of required torque.
      → **En masse** closure would lead to **50:50** closure.
    - Rectangular wire with the smallest side at least 18 mil:
      Preferred **19x25 Beta-Ti**
      → More efficient, but more difficult for forming than 18x25 SS.
      → 19x25 SS = too stiff, no failsafe design possible.

- One stage space closure with segmented arch technique
  - The anterior teeth are incorporated in a segment and the posterior right and left teeth in individual segments.
  - The posterior teeth on both sides can be stabilized by a lingual arch.
  - Retraction springs can be used to connect the stable bases and the activation is varied to produce the desired pattern of space closure.
    (positioned into the auxiliary tube on the first molar and a rectangular vertical tube on the canine or on the anterior wire segment).
  - Cave: Not fail safe: Arch form and vertical relationship are not maintained if a retraction spring is distorted or activated incorrectly.

	  3-piece base arch
Moderate anchorage situations: Space closure with the **18-slot edgewise**	- 18-slot appliance fits better for a design with closing loops. (18 -slot is too narrow for good sliding: Tight clearance, low strength of 17x25 archwire). - The wire slides through the brackets / tubes only when it is being activated. After that, when the closing loop returns to its original configuration, the teeth move with the archwire, not along it → no resistance to sliding. - Ideal closing loop = delta-shaped loop in 16x22 ss activated by opening with 10 mm wire in the loop. Activate the upper horizontal portion of the loop so that the vertical legs are pressed lightly together when the loop is not activated. **1-1.5 mm activation**. - Activation of the loop: o Bend the archwire gingivally behind the last molar. o Place an attachment (usually a soldered tie back) on the archwire so that the archwire can be tied with a ligature in the activated position. - Gable bends must be reactivated after 3-4 mm space closure. - If heavier wires are used, the loop design should incorporate additional wire for better force-deflection characteristics. - Adjust the gable bends to the springiness of the loop and the width of the brackets. - Wide brackets are not recommended when closing loops are used. - <u>Specific recommendations for closing loop archwires with 18-slot appliance & narrow brackets:</u> o **16x22 ss** wire. o **Delta** or T-shaped loops. o 7 mm vertical height, additional wire incorporated into the horizontal part of the loop (to make it equivalent to **10 mm** height). o **Gable bend of 40-45° total** (half on each side of the loop). o Loop placement 4-5 mm distal to the center of the canine tooth, at the center of the space between the canine and second premolar with the extraction site closed.
Maximum incisor retraction (maximum anchorage) **Lückenschluss A**	- 2 approaches to achieve maximum incisor retraction: • Reinforcement of the posterior anchorage. • Reduction of the strain on the posterior anchorage = Combination of o Eliminating resistance to sliding from the retraction system. (i.e. closing loops) o Tipping the incisors and later uprighting them (Begg technique) o Retracting the canines separately (Tweed technique)
1. Reinforcement with stabilizing lingual arches **2:1** ap closure	- Mandible: o Lingual arch should lie behind and below the lower incisors, so that it does not interfere with retraction. - Maxilla: o No loops in order avoid reducing the rigidity of the wire. - Remove lingual arches after the spaces are closed. (interference with the settling is possible) - <u>If proceeded with en masse space closure: **2:1** anterior-posterior ratio for space closure.</u>
2. Reinforcement with HG and interarch elastics **3:1/4:1** ap closure	- Mx: HG - Mn: Cl.III elastics + highpull HG → Force from the upper arch is transferred to the lower arch. Easier than to place eo force directly on mn molars. - **3:1** or **4:1** space closure ratio depending on the patient's cooperation. - Cave: Extrusive component. - HG reinforces posterior anchorage, but is inefficient in comparison with skeletal anchorage.
3. 2-step frictionless retraction **3:1** ap closure	- Segmented retraction of the canines. - **3:1** retraction ratio if used with a stabilizing archwire (tpa / lingual arch). - Retraction of the canines by segmented closing loops i.e. **Gjessing spring.** - Difficult to control the position of the canines in all three planes of space, esp. vertical → not fail safe. - Added complexity and increased tx time makes skeletal anchorage more appropriate.

4. Retraction with skeletal anchorage	- Risk of excessive incisors retraction → aesthetic ↓ - <u>Maxilla:</u> - Ultimate reinforcement of anchorage, used to avoid 2-step space closure. - Bone screws in the palate or individual bone screws in the alveolar process. - Direct anchorage: Upward & backward direction of the pull. - Indirect anchorage: Force direction parallel to the occlusal plane - 22-Slot: Sliding along a 19x25 ss with an A-NiTi coil spring. - 18-Slot: Bone screws to stabilize the posterior segment while closing the extractions spaces with loop mechanics. - Evidence: ○ *Lagrave, 2010 & Sandler,2014*: Alveolar bone screws are not more effective than a Nance appliance. (both moderate) ○ Palatal screws are effective to avoid molar mesialization during incisor retraction (*Lee, 2013*), esp. when 2 screws are used (*Hourfar, 2015*). - <u>Mandible:</u> - Locations for skeletal anchorage: ○ Bone screws in the alveolar process. ○ Bone screws in front of the ramus. ○ Anchors placed vertically into the buccal projection of the mn body below the molars. - Bone screws in the alveolar process in the mn & mx are probably comparable. (ø evidence) - Mn bone screws in front of the ramus can be compared with mx screws in the palate. (ø evidence) Long screw in the ramus are more invasive.
Minimum incisor retraction **Lückenschluss C**	- Incorporate as many teeth in the anterior anchor unit as possible. - Extract rather the 2nd than 1st premolar: → The amount of incisor retraction will be less, the further posterior in the arch an extraction space is located. - Place an active lingual root torque in the incisor section: Preventing the incisors crowns from tipping forward tends to pull the posterior teeth forward. (=Row-bow-effect). Note: Anti-row-boat effect: Incisors are pulled back (tip back molar + arch length secured)  - Break down the posterior anchorage: Moving the posterior teeth forward one by one at a time. - Skeletal anchorage with bone screws in either arch in the canine region = easiest and most effective way esp. if more forward movement is needed on one side than the other.

Proffit Chapter 17:

Comprehensive Treatment: Finishing

- Begg technique:
  - Major root movements of the anterior & posterior teeth had to be done with auxiliary springs, after closing the extraction spaces.
  - Auxiliary springs are augmented with rectangular archwires in the modern Begg technique with tip-edge brackets.

- Edgewise technique:
  - Adjustment of individual tooth positions to get the marginal ridges leveled.
  - Precise in-out positions of the teeth.
  - Overcome errors produced by bracket placement or the appliance's prescription.
  - Alter the vertical relationship of the incisors if necessary.

- Sequence of arches in modern edgewise technique:
  - Use the most efficient archwires to minimize clinical adjustments and chair time.
  - Necessity to fill (or nearly fill) the bracket slot in the finishing stage with appropriately flexible wires to take full advantage of modern appliances.

22-Slot Appliances

Nonextraction

16 A-NiTi
16 steel (accentuated/reverse curve)
18 steel (accentuated/reverse curve)
21 × 25M-NiTi
21 × 25 beta-Ti

Extraction

16 A-NiTi
16 steel (accentuated/reverse curve)
18 steel (accentuated/reverse curve)
19 × 25 steel, A-NiTi coil springs
or 18 × 22 steel T-loop or 19 × 25 beta-Ti delta loop
21 × 25M-NiTi (if roots displaced, usually needed)
21 × 25 beta-Ti

For a typical adolescent patient with malocclusion of moderate severity.
(Wire sizes in mil.)