Adjunctive Orthodontics

- Tooth movement to carried out to facilitate other dental procedures necessary to control disease, restore function, or enhance appearance
    - Facilitate other dental work
    - Limited in time and scope (specific goals)
    - Adults only

Records

- Traditional ortho records
- Additional radiographs to confirm absence of caries and perio disease
- Mounted models

Indications

- Pre-prosthetic positioning of teeth
- Alignment of teeth in traumatic occlusion
- Forced eruption (subgingival caries or fracture)
- Orthodontic extraction

Sequencing

- Comprehensive treatment plan
- Disease control
    - Re-evaluate
- Establish occlusion (ortho)
    - Stabilize
- Definitive perio/restorative treatment
- Maintenance

Molar Uprighting

- Direction/distribution of occlusal forces
- Decreased reduction needed for draw
- Decreased possibility of endo/perio/other tooth complications
- Increased restoration durability, eliminates plaque retentive areas
- Improves alveolar contour, crown/root ratio

- Considerations
    - Incisor position – crowding, OB/OJ, proclination, midline
    - Anchorage support
    - Space present, status of edentulous area
    - Distal crown movement vs mesial root movement
        - Easier to tip crown distally
        - Molar will try to extrude – include intrusion mechanics, crown reduction
        - Premolar alignment/spacing may be affected
- Mild Tipping
    - No special mechanics
    - Leveling and aligning with continuous superelastic archwire, or with SS wire with push coil spring
    - Reinforce anchorage unit, ideal bracket positioning
    - Requires relieving of occlusion
- Severe Tipping
    - Rigid wire for anchorage units plus auxiliary spring (19x25 SS, 17x25 TMA)
    - Molar tends to extrude, anchorage unit tends to procline and intrude
    - Bend back wire to provide mesial root movement
- Retention after Uprighting
    - Relapse can occur quickly
    - Retention needed until final prosthesis is placed

Pre-Prosthetic Alignment

- Fixed Appliances
  - Distribution of spaces
  - Leveling and alignment
- Removable Appliances
  - Limited number of aligners
  - Spring aligners
- Indications – longevity of perio and restorative, better gingival architecture, easier tooth preparations

Forced Eruption

- Fractures/caries crown involving cervical third of root
- Access for rubber dam for endo treatment
- Allows for adequate tooth structure to be exposed for restoration
- Reduction of perio defects
- Localized effect (does not compromise bone support of adjacent teeth)
- In healthy individs, bone and gingiva follows dental movement
- Fiberotomoy of junctional epithelium and supracrestal CT attachment to avoid bone formation ***OR*** post-orthodontic recontouring of bone and gingiva
- Tooth should be erupted at least 4mm from alveolar crest (2mm ferrule and 2mm biologic width)
- Importance of C:R ratio
- Erupt at 1mm/wk, stabilize for 6 weeks

Orthodontic Extraction

- As bone follows tooth, ridge can be developed for implant placement
- Frequent recalls needed to equilibrate crown, or fiberotomy
- Re-contouring of gingiva or bone may be required

Crossbite Treatment

Classification

Anterior	Dental
Posterior	Skeletal

Anterior Dental Crossbites

- Most commonly involved – lateral incisors
- Etiology
  - Over-retention of deciduous teeth
  - Crowding, blocked out teeth
- Molar relationship typically Class I
  - MUST evaluate patients for possible Pseudo-Class III
- May need to open the bite prior to [tongue blade] therapy
- Timing and cooperation are keys to success
  - Posterior crossbites and mild/moderate anterior crossbites should be treated early
    - All shift should be treated immediately
  - Severe class III patterns should be delayed (orthognathic treatment)
- Consider what happens to lower incisors
- Compare the Mx and Mn arches to other cranial bones to see if one is narrow
- With anterior crossbites, check for midline deviations and shifts

Anterior Skeletal Crossbites

  - Generally involve multiple teeth
  - Often presents with combined anterior and posterior crossbites
  - Associated with Class III growth pattern, molar relationship Class III
  - MUST be differentiated from pseudo class III cases
- Growing patients
  - Growth modification is still possible
  - ATTEMPT to "jump the bite" (facemask)
  - Mild/moderate cases benefit from EARLY treatment
  - Severe cases might benefit from single phase treatment (orthognathic surgery)
    - Hard to differentiate moderate vs severe
    - Always try facemask first, then go to single phase treatment
- Non-growing patient
  - Orthodontics (extractions)
  - Combine with orthognathic surgery – mandibular setback and/or maxillary protrusion

Posterior Dental Crossbite

- Treatment Timing
  - CR:CO shift (lateral shift) = treat ASAP
  - No CR:CO discrepancy = can consider waiting, may be more economical to treat in single phase
- Removable appliances
  - Rate of expansion must be slow, force employed during process must be low because faster expansion produces higher forces that create problems with retention of the appliance

- Fixed appliances
    - Mixed dentition = W-arch, quad helix
    - Perm dentition = TPA, expanded archwire, labial expansion arch, cross-elastics with fixed appliances
        - Cross elastics (very common) – buccal side of one arch to lingual side of other arch
    - Slow expanders in young kids produce 1/3 skeletal and 2/3 dental effects (ex:// quad helix)
- Retention – HAWLEY retainers

Posterior Skeletal Crossbite

- Multiple teeth involved, Mx arch is NARROW compared to Mn arch
- Buccal movement for Mx teeth within alveolar bone is very limited without skeletal expansion

- Treatment timing – success is age dependent, BEFORE palatal suture closes
- Options – all require over-correction and long term retention (Hawley retainers)
    - RME/RPE = rapid maxillary expansion
    - Slow Mx Expansion = quad helix
    - SARPE = surgically assisted rapid palatal expansion
- Slow expansion = 0.5mm/wk
    - In young patients (<9 y/o), has potential to cause orthopedic movement (mid-palatal suture expansion)
- Rapid expansion = 0.5mm/day
    - Theory = rapid force would not allow time for teeth to move
    - Midline diastema appears if treatment is working
    - Hyrax and Haas appliances = bonded, recommended for open-bite tendency
        - Haas has an acrylic button, whereas Hyrax does not (only metal connector in palatal area)
    - During RPE, palatal suture area is filled with fluid and hemorrhage first, then slowly integrates
        - Appliance should be kept passive for at least 3-4 months for stability
        - Midline diastema decreases and may disappear
- Considerations for Mx expansion
    - Extrusion of posterior teeth (except for bonded expander)
    - Buccal tipping
    - Gain arch length – expansion is 70% around arch perimeter: expand by 10mm = 7mm perimeter increase
    - Relapse

Dental Crowding – Expand or Extract

- Extraction = loss of tooth, but more stable
    - May be needed for severe crowding, incisal proclination and/or protrusion, jaw discrepancy
- Expansion = more prominent teeth
    - Mn Expansion Limitations
        - Analyze soft tissue
        - Fenestrations of alveolar bone
            - Increasing risk of fenestration of premolars and molar roots if >3mm expansion
        - Stripping of gingiva
- Soft Tissue Analysis
    - When incisor prominence creates excessive lip separation at rest = extraction
    - Size of the nose and chin has profound effect on relative lip performance
- Intercanine distance decreases with time

Deep Bites

- Ideal deep bites = 2mm (50% population)
- Severe deep bites >5mm
    - 20% of kids
    - 13% of adults
    - 2x as common in Caucasians vs Hispanics or African Americans
- Open Bites >2mm (3.5% all age groups)
    - 5x more common in African Americans vs Caucasians or Hispanics

Etiology

- Hereditary factors
- Environmental factors
    - Variation in dental eruption, alveolar growth, neuromuscular (especially tongue), oral habits
- Often multifactorial – always check for habits in an open bite patient

- Equilibrium Theory
    - Duration and frequency of force are important
        - 6 hour threshold (but <6h durations can still cause malocclusion
    - If lips cannot come together, tongue is overpowering (causing incisal flaring)

Tongue Thrusting/Swallowing

- For open bites, tongue must be pushed anteriorly to create an anterior seal
- 10x more people have a tongue thrust swallow than have an open bite
- Open bite may be related to tongue posture, not to tongue activity during swallowing
    - If you find any functional problem, eliminate it immediately

Mouth Breathing

- Total nasal obstruction (very rare) can cause altered vertical growth pattern
- Majority of people with long face pattern have NO evidence of nasal obstruction
- May contribute, but is unlikely to be the main cause of skeletal open bites
- Palatal expansion may cause nasal expansion, is useless if patient continues to mouth breathe

Digit Sucking

- Flared, spaced upper incisors, lingually positioned lower incisors
- Anterior open bite, narrow upper arch
- Usually requires treatment if habit continues after primary dentition
- If habit stops BEFORE eruption of permanent incisors, most changes resolve spontaneously
- Narrow upper arch MAY correlate to posterior crossbite
    - Pedo – stop habits at 3y/o
    - Ortho – stop habits at 5y/o
    - Principle – when you see habit, try to stop it immediately
- Intervention
    - Talk with the kid
    - Reminder therapy
    - Reward system
    - Elastic bandage
    - Habit appliance

- Compliance is the most important key – best compliance comes from a cemented crib appliance

Diagnosis

- Patient interview – habit, pathology
- Clinical exam – facial proportions, curve of spee
- Cephalometrics – MP > 35°, UFH:LFH 43:57
  - Only way to tell between dental vs skeletal problems
- Consider:
  - Gummy smile, impinging OB, occlusal contacts only on molars?
  - Where there is excessive OJ and crowding, lower incisors tend to supraocclude

Dental Deep Bites

- May cause palatal/gingival soft tissue trauma
- Goals of treatment
  - Increased posterior eruption (lower, if class II tendency)
  - Inhibit eruption of anterior teeth
  - Allow Mn to grow and rotate downward backward w/o excessively decreasing chin prominence
- Treatment Options
  - Early treatment (trauma = start treatment immediately)
  - Level and align dentition
  - Proclination of upper incisors
  - Molar distalizers, bite plates with vertical elastics on posterior teeth, intrusion arches to anterior teeth
  - Deep bites are usually paired with Class II patients
    - Extractions – pulling anterior posteriorly will cause some extrusion – bad for open bite patients
    - Deep bite – extruding molars to open bite will rotate Mn open and decrease chin prominence

Dental Open Bites

- Either self-correcting or respond readily to myofunctional treatment and mechanotherapy
- Goals
  - Inhibit eruption (or intrude) posteriors – easy to treat, minimal force needed
  - Increase eruption of anterior teeth
  - Allow Mn to grow and rotate upward and forwards
    - Open bites with Class III = difficult, treating one makes the other worse and vice versa
- Treatment Options
  - Early treatment
  - Stop habit/myofunctional therapy
  - Level/align dentition
  - Retroclination of upper incisors
  - Orthodontics with extractions
  - TADs, bite plates with vertical elastics
    - Bite plates to try intruding molars
    - Avoid elastics and banding of 2nd molars (vertical movement component)

Skeletal Deep Bites

- Short face, flat Mn plane and long Mn ramus
- Tendency towards upwar and forward Mn rotation
- Often have excessive incisor eruption

- Treatment options
  - Early treatment
  - Level and align dentition, procline upper incisors
  - Cervical headgear, modified functional appliances to allow molar eruption
    - Cervical headgear extrudes molars as Mx moves posterior
  - Orthognathic surgery
- Functional appliances can be quite successful with short faced class II kids
  - Consider the compliance factor (removable twin block vs fixed herbst appliance)

Skeletal Open Bites

- Long face, convex profile
- Steep Mn plane, short Mn ramus
- Tendency towards downward and backward Mn rotation
- Often have excessive molar eruption

- Treatment options
  - Single phase treatment
  - Stop habit/myofunctional therapy ASAP
  - Orthodontics with extractions
  - High pull headgear, bonded expanders, TADs, functional appliance with posterior biteblock
  - Orthognathic surgery
  - Vertical growth is the last growth component to stop, wait until 2nd molars are full erupted before treating skeletal open bites (total treatment time is then shorter)
  - Only reason to treat earlier is to eliminate an oral habit

Facial Proportions

- Ideal vertical proportions – 1/3
  - Trichlon – soft tissue glabella – subnasale – menton
    - Outer canthus – commissure is also 1/3
    - Lower facial 1/3 height
      - Bottom of nose to bottom of Mx lip = 1/3
      - Bottom of Mx lip to menton = 1/3
- Ideal horizontal proportions – 1/5
  - Inner canthi – outer canthi – edge of face

- Nasiolabial angle = 85-105°
- Profile angle = 165-175°
- Orthocephalic angle = 88.5-86.2°

Incisor Display

- 75% incisor to +2mm gingival display
- Excess Incisor Display
  - Vertical maxillary excess
    - Maxillary impaction, growth modification
  - Gingival hypertrophy
    - OHI, gingivectomy
  - Altered passive/active eruption
    - Short gingival crown lengths and uneven gingival margin positions
    - Excessive bone
    - Biologic width attachment at/coronal to CEJ
    - Osseous surgery → gingivectomy
  - Retroclined Mx incisors
    - Relative extrusion/intrusion
  - Anatomically short Mx lip
    - Lip length <18mm
    - Mx impaction may result in short lower facial height, brachycephalic face
- Insufficient Incisor Display
  - Low attached frenum
  - Anatomically long upper lip
    - Infrequent
    - Lip length >22mm
    - Mx downfracture man result in increased lower facial height, dolicocephalic face
  - Vertical maxillary deficiency
    - Anterior deficiency
    - Posterior excess
  - Short clinical crown height
  - Proclined Mx incisors

Dental Problem List

- Anterior open bite (6mm)
- TSALD – excessive proclination
- Narrow maxilla (end to end bite)

Age Changes

- Mx lip is thickest between 14-16y/o
- Lips elongate during adolescence

Orthognathic Surgery

Four Indications

- Orthodontic camouflage unattainable
- Orthodontic camouflage possible but:
  - Esthetically undesirable
  - Surgery is easier, quicker, more palatable
  - Patient desires surgery for better facial esthetics

Advantages of Orthognathics

- Psychosocial reasons
- Normalization of skeletal and occlusal relationships
- Normalization/improvement of
  - Mastication
  - Respiration
  - Deglutition
  - Phonetics
- Perio situations – destructive deep bite, boggy gingiva, thin tissue biotype, etc

Surgery for the Patient

- Mention surgery if you see:
  - Growth potential
  - AP discrepancy > 3mm
  - Mentalis flexure, lip incompetence, etc
  - Noticeable retro/prognathic profile
  - Unilateral crossbites in non-growers
  - Facial asymmetries in the horizontal plane
  - Narrow maxilla in non-growers
- Treatment Timing
  - Class II – surgery at the height of growth, or after growth completion
  - Class III – surgery after growth completion
- Mn procedures
  - Requires stable TMJs
  - Class II with normal growth rate and Mn osteotomies = stable
  - Deficient growth rate = infrequent return to Class II
  - Accelerated growth rate = frequent return to Class III
- Mx procedures
  - LeFort I = inhibits further Mx growth
    - Vertical Mx growth rate is unchanged, but direction becomes inferior posterior
  - Surgically assisted RME inhibits post-op AP growth
  - Mx impaction and advancement surgeries = most stable and successful

Invisalign

- Intermittent force type

Basic Steps

- Create 3D virtual dentition
- Complete computer based treatment planning to visualize final results
- Create series of clear aligners to move teeth to desired result
- Monitor clinical response – modify as needed

1. Detailed impression and bite registration taken (in VPS, not alginate)
    a. Same diagnostic records as other orthodontic treatment
        i. Clinical exam
        ii. Photographs
        iii. Lateral cephalometrics
        iv. Panoramic radiograph
        v. Diagnostic models
2. Align technology aligns teeth, doctor reviews setup and approves treatment protocol
    a. ClinCheck is computer based, can be used to educate patients visually
    b. Best movements = buccal/lingually, small AP movements, small rotations of non-round teeth
    c. Difficult movements = large vertical movements, large rotations of round teeth, root movement
3. Create aligners
4. Clinical progress
    a. Attachments – placed to provide a “handle” on the tooth to improve tooth movement

Indications

- Crowding $\leq$ 6mm
- Spacing $\geq$ 9mm
- Minor AP movements
- Deep bite
- Dental crossbites
- Great for treating mild relapse after fixed appliance therapy

Contraindications

- AP discrepancies > 2mm
- Open bite
- Severely rotated teeth >20^{o}
- Severely tipped teeth > 45^{o}
- Teeth with short clinical crowns

Retention and Retainers

- Allows reorganization of gingival and perio tissues
- Minimizes changes due to growth
- Permits neuromuscular adapation to correct tooth position
- Maintain teeth in inherently unstable position after treatment

Origins of Post-Op Changes

- PDL fibers need >200 days to reorganize and can derotate teeth after 1 year
- Supracrestal gingival fibers need 1 year to remodel
    - Circumferential supracrestal fiberotomy – for when subgingival fibers have been significantly displaced by derotation
- Orofacial soft tissue resting pressure
- Post-treatment facial growth/development late Mn growth
- Occlusal factor – anterior component of occlusal forces (mesial drifting)

Removable Retainers

- Hawley Retainer
    - Preferred for maxilla, especially after arch expansion
    - Allows for occlusal settling, can be modified to allow for tooth movement (active retainer)
- Wrap-Around retainer – same as Hawley, but labial bow wraps around buccal side of all dentition
- Active retainer – removable appliance that acts as a retainer after repositioning teeth
- Vacuum formed retainer – cheap, fast, doesn't allow for occlusal settling, cannot be modified

Fixed Retainers

Maintenance of lower incisor position during late growth Prolonged retention of corrected rotations Maintenance of diastema closure Maintenance of pontic/implant space Keeping extraction spaces closed in adults	Hinders interdental cleaning Risk of caries, especially under bonding if it fails Retains only anterior segment Requires considerable maintenance Must sit passively before bonding Must be covered by at least 0.25mm of composite (may affect opposing dentition)

Informed Consent

- Full Disclosure
- Capacity
- Voluntary

Hierarchy of Informed Consent

- Video tape consultation
- Audio tape consultation
- Have patient write out R/B
- Use of commercially available form
- Documentation in chart (with or without patient signature)
- Document consent given granted in charge
- No documentation

Tips for Providers

- Personalize a given consent form on the form, so it shows you went through the form with the patient
- NEVER let the patient modify the form
- Use a vetted/endorsed form from your association
- Informed refusal = patient refuses treatment
    - MUST disclose risk of non-treatment, complications, results
    - Document on separate page, sign, and date
- Children want to be included in deciding their own treatment
- Remember, orthodontics is ELECTIVE – used to enhance long term quality of life
    - Informed consent is VITAL for elective treatments
    - As elective condition severity increases, so does decision making autonomy
        - Preference sensitive
    - As non-elective/medical condition severity increases, decision making autonomy decreases
        - Technique sensitive

Ortho for the GP

- The role of the general dentist as the primary dental care provider
  - Captain of the team
    - Evaluation of occlusion should be part of routine dental exam
    - Triage of problems
    - Appropriate timing of referrals
  - Early detection of a problem
    - Is there an alignment problem – crowding
    - Incisor protrusion – intrusion
    - Posterior crossbites
    - AP discrepancies (molar relationship)
    - Vertical problems
      - Anterior crossbites from anterior Mn shift and posterior crossbites with a lateral shift should be treated in the early dentition
  - Elimination or referral to orthodontist to eliminate problem's etiology
  - Retention follow-up and OH maintenance
    - Re-evaluation at each hygiene appointment

What should general dentists treat?	Changing your office to accommodate for ortho
- Only Class I patients (50-55% of the population)? What about rural areas and no ortho nearby? - Guidance of eruption? - Space management during mixed dentition? - Serial extraction? - Midline diastema - Dental crossbites - Crowded permanent dentition - Forced eruption - Molar uprighting - Full (comprehensive) treatments - Limited treatments - Invisalign	- If ortho is performed, is there any special consent form? - Any changes in the schedule? What equipment needs to be purchased? - Any payment plan? How to generate ortho fees? - How to market? - How to incorporate Invisalign?

Treatment Modalities

- Space maintenance/regaining
  - Band and loop
  - Distal shoe
  - Lingual arch
  - Lip bumper
  - Utility arch
- Molar uprighting
  - Re-establishment of 3mm or less by distorotation and tipping
  - Band Mx 2-2 with 0.016wire
  - Headgear with vector tipping force occlusal to center of resistance
- Forced eruption
  - Fast movement (3-6 weeks) – no alveolar bone movement
  - Gingival crown lengthening may be required in addition to orthodontics before restorative care
  - Indicated for defects in cervical 1/3 of root secondary to fracture, decay, resorption

Treatment Timing

- Screen by 7y/o
    - Posterior occlusion is established
        - Evaluate AP and transverse relationships in occlusion
        - Look for functional shifts
    - Incisors have begun to erupt
        - Crowding, habits, deep bite, open bite, facial asymmetries

Discrepancies

- Anterior crossbite – attrition and perio breakdown from traumatic occlusion
    - Early mixed dentition – usually removable appliance of limited fixed appliance
- Skeletal anterior crossbite
        - Check for CR:CO shift – pseudo class III
        - Mn prognathism – Class III facial appearance
        - Typically multiple teeth involved
    - Mixed dentition – limited braces ± reverse pull headgear (effective up to age 10)
        - Jump the bite while growth still possible
        - Roughly 1/3 of early treatment will not maintain overjet
        - Fixed appliances with extractions (camouflage) or orthognathic surgery
- Posterior skeletal crossbite
        - Unilateral vs bilateral
        - Shifting may cause asymmetric growth, facial asymmetry
    - Treat ASAP, may opt to wait for first permanent molars to erupt
        - Hyrax or quad helix – retention is critical
- Posterior dental crossbite
        - No CR:CO shift present, usually involves single or only a few teeth
    - Treat in permanent dentition with fixed appliances
- Dental asymmetry
        - From unilateral loss of primary canine or first molar – tendency towards crowding
    - Treat ASAP – extraction of contralateral tooth, or space maintenance
- Incisor liability
    - Crowding in the early mixed dentition, resolves with canine eruption and Mn growth
        - 2mm crowding expected
- Moderate crowding
        - Severe rotations and parental concerns with esthetics warrants limited fixed treatment
    - Timely placement of a lower lingual holding arch, but wait until permanent dentition for full treatment
- Severe Crowding
        - Sign = premature loss of canines
    - Serial extractions is one treatment method

- Eruptive Anomalies
    - Contralateral tooth should erupt ± 6 months
    - Sequences should be preserved
    - Radiographically investigate canines if:
        - Cannot palpate by age 10
        - Asymmetry in palpation and/or eruption between left and right sides
        - Missing or anomalous adjacent lateral incisor combined with inability to palpate canine
        - Canine Eruption Zones
            - Distal ½ of lateral root = Zones 1&2
            - Mesial ½ of lateral root = Zones 3&4
    - Ectopic Molar Eruption
        - Treat immediately, avoid extracting primary molar if possible
- Open Bite
    - Suspect habits (partially erupted incisors)
    - If true skeletal open bite, orthodontic evaluation ASAP
- Excessive Overjet
    - Evaluate in early mixed dentition
        - Typically Class II
    - Best treated single phase in late mixed/permanent dentition