Presurgical Orthodontic Preparation for Optimal Outcome

Treatment Planning of Surgical Orthodontic Cases

Consensus Sequence:
Pre- and Post-Surgical Orthodontics

Orthodontic plan
Preliminary surgical plan (VTO + STO)

Pre-surgical Orthodontics

Final surgery plan
Orthognathic surgery

Minimal post-surgical orthodontics

Goals of Pre-Surgical Treatment

Establish incisor position (A-P)
- Either exactly where they should be at completion, or slightly overcorrected
- Establish interincisal angle
- Dependent of 1/-SN and /1-MP
- The positioning of the incisors has a substantial effect on the aesthetic outcome

Incisors Inclination & ANB

- Proclination of Mx incisors → ANB decrease
- Proclination of Md incisors → ANB increase
- Pre-surgical inclination has a direct impact on skeletal surgical correction
- Inadequate incisors decompensation likely decrease the skeletal AP changes

Advantage of Adequately Decompensated Incisors

- Adequate preoperative decompensation
- Permit optimal skeletal AP changes
- Normalizing incisor inclination only by surgical movement without appropriate preoperative decompensation can increase the surgical morbidity and compromise the facial aesthetics and stability
Problems Created by Inadequately Decompensated Incisors

- Inadequate incisor positioning
- Can compromise buccal interdigitation
- Can substantially affect the aesthetic outcome
- Class I buccal segments are not attainable
- Retroclination 1/ (or too much retraction)
  - Insufficient room to provide for adequate Md advancement
  - Increase the need to compensate by more genio advancement
  - Risk for limiting success in improving overall health (Tx of sleep apnea)

Sarver D., How to avoid surgical failure, Sem. Ortho 1999;5: 257-274

Problems Created by Inadequately Decompensated Incisors

- Proclination of Md Incisors-Cl II
  - Decrease the amount of Md advancement
  - Risk of limiting success in improving SAS
  - Increase the chin advancement to compensate for the lack of Md advancement

AP Incisors Position- Cl III

- Proclination of Mx incisors or Retroclination of Md incisors
  - Insufficient negative overjet preparation for adequate Mx advancement or Md setback
  - Decrease the amplitude of surgical skeletal correction
  - Inability to achieve Cl I buccal segment

Decompensation in Class III

- Unraveling crowding of 1/
- Use Cl II elastics
**Decompensation in Class III**

- Extraction of premolar, 4s/ or 5s/ or 4s/5s or 5s/5s

PuCle Apr 2012  
Sept 2012  
May 2014

Kim, Do-Keun et al. Change in maxillary incisor inclination during surgical-orthodontic treatment of skeletal Class III malocclusion: Comparison of extraction and nonextraction of maxillary 1st premolars, AJODO 2013;143:324-35

**Optimal Decompensation**

- Missing 14, 15, 24, 25, 35, 45

**AP Incisors Position- Torque**

- Proclination of both Mx and Md incisors
  - Incisors retraction (bimax reduction) facilitates obtaining positive overbite
  - Conversely, iatrogenic proclination favors opening of the bite

**Open Bite + Bimax Protrusion**

- Extraction of all 2nd Pm
- Mx: Space closed on segmented arch
  - Self leveling of Mx Curve of Spee

**Incisor Extrusion on Stability of Anterior Open bite**

- Moderate extrusion or absence of pre-surgical extrusion has little effect on the long-term stability of open bite
- The decrease in overbite depends on the influence of several factors: dental, skeletal, soft tissues and condylar remodelling

**Incisor Extrusion on Stability of Anterior Open bite**

- If the curve of Spee does not level by itself when closing extraction space in segmented approach
  - No attempt was made to extrude anterior teeth
  - Leveling was made surgically
**Skeletal Etiology of OpenBite**

- Distance apex-hard palate
- Occlusal plane
- Short ramus

**Goals of Pre-Surgical Treatment**

- **Vertical**
  - Level or intrude lower 2nd molars
  - Do not extrude upper 2nd molars
  - Often time lingual cusp is hanging down

**Occlusal Plane Alteration**

- Clockwise rotation
  - Decrease 1/\(\angle\) + chin projection
  - Increase /1-MP \(\angle\)

- Counterclockwise rotation
  - Increase 1/\(\angle\) + chin projection
  - Decrease /1-MP \(\angle\)

**Occlusal Plane Alteration + C_{Rot}**

- Clockwise rotation
  - 1 occlusal plane angle
  - FMA
  - Chin rotate posteriorly 1 PPH
  - Perinasal structures advance
  - \(\perp 1/\perp\)
  - \(\perp 1/\perp\)

(See references: Wolford LM, Chemello PD. AJODO 1994;106:304-16.)

What do you Have to do Before Surgery?

- Obtain a flat occlusal plane ➔ Level the curve of Spee
- Courbe de Spee = 0
- Levelled marginal ridges
- Extraction site closed
- Alignement of the cusp MD
- Grind the interferences on the models and repeat it in the mouth
- Hand articulated models should fit in Class I

What Happen if the Curve of Spee is not Leveled?

- Final AP position of /1 is unknown
- Optimal surgical movement is difficult to estimates
- Post surgical ortho will take long
- Incisors AP will likely change; hence affecting surgical correction
What Happens at Surgery?

- Mandibular distal segment will rotate clockwise
- Proximal segment is maintained in the fossa
- No further AP movement of /I will occur

What is the Advantage of Presurgical Flat Curve of Spee

- Permits optimal occlusal outcome per-op

What is the Advantage of Optimal Orthodontic Decompensation?

- Per Op
  - Permits maximum interdigitation
  - Permits class I occlusion
- Please note
  - To surgically close an anterior openbite do not create a posterior openbite

What Can be Done After Surgery?

- Root parallelism
- Finishing and detailing posterior occlusion
- Minor transverse problems
- Closing residual space if any

Satisfaction and Self-Esteem Post Surgery

- Overall satisfaction and self-esteem increase during the first 4 months post surgery
- Decline at 9 mois
- Conclusion
  - End treatment 4 to 6 months post surgery

Treatment Sequence Surgery 1st

3D imaging, Surgical plan chirurgical
Postsurg ortho plan, template-splint
Ortho appliance only, no AW or passive stabilizing wire
Orthognathic surgery (+dentoalveolar surgery, corticotomy), TADs / miniplates for anchorage
Extensive post surgical orthodontics (9-15 months). Increasingly difficult if incisors are not in correct vertical position
**Surgery 1st**

- Is it a good idea?
  - The idea behind its introduction: the biggest problem is addressed first, so the patients are more pleased with the treatment experience
  - Minimal or no evidence to support this
  - Kiyak et coll (Seattle 1990s): > 6 months post-surg orthodontics becomes a problem for patients
  - Compromise in occlusion and alignment post treatment?

**Orthosurgical Tx vs Surgery 1st**

- An orthosurgery tx requires orthodontic decompensation certainly, but the post surgery finishing is not that long.
- The deal is: Do the surgery at the right time.

**Surgery 1st**

- Perhaps easier now with 3D CAD/CAM planification
  - Typically requires segmental jaw surgery and multiple splint fabricated from virtual models
    - Bone screws / miniplates added for orthodontic anchorage
    - Dentoalveolar corticotomy
    - Increasingly difficult if the incisors are not in the correct vertical position

- Outcome data
  - Patient satisfaction: high
    - But no comparison to other satisfaction reports in the literature
  - Treatment time reduced
    - But corticotomy, more frequent orthodontic appointments and perhaps less precise orthodontic finishing may have affected this
  - No data
    - Complications
    - Quality of final occlusion
    - Stability

  - 45 of 230 ortho-surg patients selected for surgery 1st
  - Exclusion
    - Severe crowding requiring extraction
    - Severe asymmetry with dental compensation in the 3 planes of space
    - Cl II div 2 deep bite
    - Periodontal problems and TMJ dysfunction/symptoms

- The absence of dental decompensation affects the quality of the dentoskeletal correction ...
  - Should not an optimal skeletal correction be aimed at?
Surgery 1st

- Technically difficult, but good results achievable
- Contre-indications: severe crowding, deep overbite
- Higher patient satisfaction?
- Faster treatment time?

**The key question:**
For which patients is it cost-effective, with cost including effect on patient?

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Visual Surgical Treatment Objectives

**VTO**

- Dental objectives
  - Assessment of /1-MP
  - Assessment of 1/-SN
- Surgical objectives
  - Le Fort 1
  - BSSO
  - Genio

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Hyperdivergent Cases

- Place /1-MP at or near 90°
- Obtain ideal 1/-SN or slightly higher
  - Clockwise rotation of the occlusal plane decrease 1/-SN
  - Counterclockwise rotation of the occlusal plane increase 1/-SN
- Undertorque /1 or proclined /1-MP reduce the Md sagittal advancement
- Flattened curve of Spee
- Any modification after surgery may reopen the bite
Class II div 1

- Constricted Mx
- Missing 46
- Md dental asymmetry
- Lower midline deviation to the right

Hyperdivergent, FMA = 42°
- Retrognathic Mx + Md (SNA=74°, SNB = 66°)
- Impacted 18, 28, 38, Mutilated 46
- Md-Md transverse deficiency
- 85-62=23 (norm = 20)
- Sleep apnea syndrome

Tx Plan?

- Presurgical goal
  - Achieve normal transverse relationship
  - Achieve symmetry of lower canines
    - Midline coordination
    - Upright lower incisors (1-MPI)
- Exo LL4
- SARPE
- Bimax surgery

End of distraction

- Note the position of the screw in line with 1st molars

Pre Phase 2 Surgery

- Arch coordination
- Midline coincident

Dental Arch Symmetry
**Upright lower incisors, \( /1-PM = 84^\circ \)**
- Permit max md advancement

**Too upright upper incisors**
- But Mx advancement is planned

**Class I occlusion achieved**
- Coordinated arch form

**Uprighted lower incisors and counterclockwise rotation of the maxilla helped to achieve maximum Md advancement**
- Genioplasty was not necessary, beside advancement of genial process
- Improved airways

**Counterclockwise rotation of occlusal plane**
+ **Full dimensional 21x25 finishing wire**
  - Help to improve \( 1/-SN \) from \( 79^\circ \) to \( 87^\circ \)

**At 61, she feel younger and healthier than in her mid 50s**

**Complication**
- Bruise post SARPE
- Infection cause by remnants of partial odontectomy
- Sequestra and plates was removed on the left.
Class III Open Bite

- Maxillary constriction/ Left posterior Xbite
- Moderate crowding
- Mandibular tori

Hyperdivergent, FMA = 41°

- Vertical excess: maxilla and lower facial 3rd
- Laterodeviation to the right
- Bimax dentoalveolar protrusion

Left condylar hyperplasia (or right condylar hypoplasia)

- Impacted 3rd molars

Surgical Treatment Objective

- Le Fort 1 superior repositioning 3 mm
- BSSO
- Genioplasty
  - advance +5 mm, vertical - 4 mm

At 30 weeks

- Mx: 16x22 SS
- Md: 21x21x20 SS en masse retraction
- Mandibular tori were removed along with 3rd molars
At 64 weeks
- Mx: segment 21X25 TMA, distal root tip 14 & 24
- Md: 20X25 SS

Loss of 1/ torque
- 1 retracted 5.4 mm
- Long left condylar neck

3D Planning

3D Planning
- Counterclockwise rotation of occlusal plane 2°

3 weeks post op
- Arch change
- Finishing elastics
**Hyperdivergent Cases**
- Place /1-MP at or near 90°
- Obtain ideal 1/-SN or slightly higher
  - Clockwise rotation of the occlusal plane decrease 1/-SN
  - Counterclockwise rotation of the occlusal plane increase 1/-SN
- Undertorque 1/ or proclined /1-MP reduce the Md sagittal advancement
- Flattened curve of Spee
- Any modification after surgery may reopen the bite

**Normodivergent Cases**

North shore of St-Laurence river + Mont Ste-Anne
Normodivergent case

- Aim for ideal 1/-SN and /1-PM prior to surgery
- Assess the amount of retraction of incisors in extraction cases
- Flattened curve of Spee to obtain maximum intercuspation at surgery

Class II div 2

- Moderate ALD

Tx Plan

- Exo 15, 25, 35, 45
- Assess 1/ & /1
  - /1: retract 1 mm, /1: retract 3 mm
- BSSO advancement ~ 4.7 mm

Prior to Surgery

- Full dimensional archwire

• 1/-SN = 104°
• /1-PM = 95°
**Post Surgery Orthodontics**

- CI II elastics
- Finishing bend

**Tx time 138 weeks**

- Class I occlusion

**Class III**

- Excess of space
- Retroclines /1; proclined 1/

- Ideal 1/ & /1 angulation
  - /1-MP = 92°, 1/-SN = 105°, 1/1 = 129°

- FMA = 26°
- /1-PM = 76°, 1/-SN = 116°
- Witts (ABOP) = -15 mm
- Cant of occlusal plane
**Visual Treatment Objective**

Dental objective

**Progress at 36 weeks**

- TADs used as indirect anchorage to assist molar protraction
- Friction will likely help proclining lower anteriors

**Progress at 44 weeks**

**Progress at 62 weeks**

- 20x25 SS will be followed by 21x25 TMA/21x25 SS

**3D Surgical Planning ProPLan CMF**

- Ls/ON = 106°
- Ls/MP = 82°
- OJ = -14 mm; witts = -18 mm
- Mid growth did occur
21 Days Post Op

- Finishing box elastics
- Bone graft infraorbital (bone came from the chin)
- Bad split on the left side

Final

- Tx time: 92 weeks
- Witts = -6 mm

Improuved Self-Esteem

Normodivergent case

- Aim for ideal 1/-SN and /1-PM prior to surgery
- Assess the amount of retraction of incisors in extraction cases
- Flattened curve of Spee to obtain maximum intercuspation at surgery

Follow up at 11 Months

- Flattened curve of Spee to obtain maximum intercuspation at surgery
Hypodivergent Cases

- Accept non-ideal proclined /1-PM prior to surgery because of chin prominence or dentoalveolar retrusion at baseline.
- Aim for ideal 1/-SN.
- Flat curve of Spee prior to surgery.
- Promote extrusion of mandibular teeth while leveling.
- Clockwise rotation of the distal segment occur in Md advancement, hence help increasing facial height.

Hypodivergent, FMA = 16°
- Proclined: 1/-SN = 121°, /1-MP = 103°
- Vertical insufficiency of lower facial height

Class II div 1
- Deep overbite impinging palate
- Mx spacing
- Light Md crowding

Tx goal
- Increase vertical dimension
- Place 1/-SN = 103° (upright incisors)
- Maintain (not procline) /1-PM

Tx Plan
- Le Fort 1:
  - Advancement 4.6 mm
  - Downward at ANS
  - Upward at PNS
- BSSO
  - Advancement 6 mm
  - Clockwise rotation of distal segment
**Mecanotherapy**

- Hawley anterior bite plane
- Md: tip back mechanism
  - Alignment in 3 segments
  - Intrusive arch attached to /3s
  - Goal: promote maximum posterior eruption of md teeth

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**At 36 weeks**

- Presurgical reassessment
- 20x25SS U & L

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**At 50 weeks**

- Post Surgical Orthodontics

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**65 weeks**

- Class I occlusion
Class II div 2

- CI II subdivision right
- Deep overbite
- Mid midline deviated to the right
- Short anterior face height
- Prominent chin

Tx Plan

- Place 1/-SN = ~100°
- Level curve of Spee by posterior extrusion
- Maintain /1-MP
- BSSO advancement ~5 mm
- Génio: Elongation 2 mm (?)
Follow up 3 months

- Mx anterior torque improved
- 21x212 wire
- Md: 19x22 TMA reverse curve Andrews

Mx: bond 6s. Stop Anterior Bite plane

- Md curve of Spee leveled

Mx: Anterior root torque auxiliary for 6 weeks

- 20x25 SS U & L:
- Preop at 65 weeks

At 65 weeks

- 1/ to SN improved from 72° to 100°
- 1/MP proclined 99° to 107°

At 74 weeks

- Post surgical orthodontics
- Class II elastics

Complication
Final Outcome

- Tx time = 106 weeks
- Class I occlusion

Hypodivergent Cases

- Accept non ideal proclined /1-PM prior to surgery because of chin prominence or dentoalveolar retrusion at baseline
- Aim for ideal 1/-SN
- Flat curve of Spee prior to surgery
- Promote extrusion of mandibular teeth while leveling
- Clockwise rotation of the distal segment occur in Md advancement, hence help increasing facial height

What Happens if There is Lack of Communication with the Oral Surgeon?

- It is important for the orthodontist to understand the surgical tx planning
- Sometimes, the surgeon may not do what you had planned
- Some orthodontists don’t have a clue on surgical tx planning

Surgical Treatment Planning

- Exo 5s/4s
- BSSO: advancement ~6 mm
- Genio: advancement ~ 7 mm + vertical reduction ~ 1.5 mm
Presurgery

- Tips: note .016 niti root spring
- Elastomeric chain to correct rotation of 4s & 6s
- Exo 15, 25, 44, missing 36

Outcome

- The surgeon did not perform the genioplasty as planned at baseline!
- Some lip incompetency persist
- Profile would have benefit from advancement of the chin
- It is important to reassess WITH the surgeon, the final surgical Tx plan.
- If I would have paid more attention to presurgical report of the surgeon, I would have pick the missing genio in the surgical plan

Surgical Treatment Planning

- Exo 5s
- BSSO: Advancement 5 mm
- Genio: Advancement 3 mm to obtain normal /1-APg & lip competency

Presurgery

- Normodivergent
- 1/-SN = 100°
- /1-PM = 93°

Outcome

- Nice occlusal outcome
- Patient would have benefited from advancement genioplasty as it was planned
Thanks for your attention

Merci de votre attention

Church Ste-Famille
Îles d'Orléans