

An overview of surgery-first approach: Recent advances in orthognathic surgery

Introduction

- First orthognathic surgery was performed by Hüllihen in 1848
- Most common approach is presurgical orthodontic treatment followed by orthognathic surgery
- Presurgical orthodontics decompensates the occlusion and allows for attainment of normal dental alignment
- Disadvantage of presurgical orthodontics includes: longer treatment time (4-47months), worsening of facial appearance and masticatory discomfort
- Concept of surgery-first orthodontics was proposed in 1991
 - o Normalizing the surrounding soft tissues allowed teeth to settle into better position reducing the total orthodontic treatment period
- Surgery-first approach is used in Korea, Japan and Taiwan

Surgery First Orthognathics

- Possible with the introduction of rigid fixation
- Planning uses computer aided surgical simulation
- Major benefit of surgery-first approach is reduced treatment time
 - o Increase in cortical bone porosity decreases resistance to tooth movement
 - o After orthognathic surgery there is increased blood flow which stimulate bone turnover potentially speeding orthodontic tooth movement
- Treatment times as short as 7 months have been reported in the literature
- By passing presurgical orthodontics can shorten treatment time by up to 1.5 years

Indications

- Mild crowding
- Flat/mild curve of spee
- Normal/mild proclination and retroclination of incisors
- Minimal transverse discrepancy
- Can be applied to Class II or Class III malocclusion
 - o Majority of cases treated have been Class III malocclusion

General Guidelines

- Upper and lower dentition is bonded but no arch wires are placed until 1 week to 1 month postoperatively
- Oseotomized jaw bones are held by rigid fixation
- Maxilla and mandible are set up in the proper molar relationship

- Class I: nonextraction, bimaxillary first premolar extraction
- Class III: lower first premolar extraction
- Class II: maxillary premolar extraction
- Postsurgical orthodontics begins as early as 1 week after surgery
 - Takes advantage of the phenomenon of postoperatively accelerated orthodontic tooth movement
- Orthopedic appliances (facemask, chin cups) can be used to maintain jaw bone position during orthodontic tooth movement

Specific Guidelines

- Anteroposterior and vertical decompensation in class III
 - Incisors are positioned surgically or orthodontically after surgery
 - Correction of proclined maxillary incisors can be achieved by:
 - Extraction of maxillary first premolars and anterior segment osteotomy
 - Clockwise rotation of the maxilla
 - Retroclined mandibular incisors
 - Moderately retroclined and crowded incisors can be set into a class I with excessive OJ and aligned postoperatively to attain a normal OJ
 - Severely retroclined lower incisors can be corrected by extraction of lower incisors and anterior segment osteotomy
 - Moderate to deep curve of spee
 - Levelled preoperatively or surgically by anterior segment osteotomy to avoid upward and forward rotation of the mandible postoperatively
 - To avoid upward and forward rotation of mandible postoperatively intrude lower incisors and extrude upper incisors
- Anteroposterior and vertical decompensation in Class II cases
 - For moderate to deep mandibular curve of spee anterior segmental osteotomy to level and intrude anterior mandibular teeth to allow mandible to be advanced properly
 - Mandible is surgically advanced to an edge-to-edge incisor relationship and mandible anterior teeth are orthodontically intruded after surgery
 - Mandible rotates up and forward for better chin projection and posterior occlusal contact
- Transverse arch coordination
 - Inter canine and intermolar widths of upper and lower teeth
 - Wide maxilla with transverse discrepancy greater than one molar width on either side could be corrected with a three-piece Le Fort I osteotomy
 - Wide maxilla with a transverse discrepancy less than one molar width on each side can be corrected postoperatively orthodontically

- Narrow maxilla could be corrected surgically with surgically assisted rapid palatal expansion

Reduced Treatment Time

- Regional acceleratory phenomenon was described by Frost in 1993
- After an osteotomy bone remodeling facilitates the healing process
- Orthognathic surgery triggers 3-4months of higher osteoclastic activity and metabolic changes in the dentoalveolus

Treatment Planning Considerations

- Molar relationship is used as a starting point to determine temporary occlusion
- Inclination of upper incisors is important to determine need for extractions
 - Upper incisors to occlusal plane $<53-55^\circ$ extractions should be considered as a treatment approach
- Midlines must be coincident (or close) after surgery
- Buccal overjet should be established bilaterally during surgery
- Most challenging aspect is prediction of final occlusion
 - Intended transitional malocclusion (ITM): term to describe the occlusion that is used to fabricate the surgical splint and surgeon's guide during surgery
 - Requires at least three-point contact
 - If ITM cannot be established orthodontic tooth movement is advised to remove some of the occlusal interferences

Protocol Variations

- Variations in bracket types, wires and surgical splints used
 - Brackets: 022, 018, no brackets
 - Wire: Stainless steel, NiTi, no wire
 - Surgical splint: during surgery, 1-4 weeks after surgery
- Wait 4-6 weeks following surgery for better stability

Use of Anchorage in Conjunction with Surgery-first Approach

- Temporary anchorage systems provide a "back-up system" to use in postsurgical phase to help orthodontic tooth movement
- Single mini-implants, titanium plates, etc.
 - Placed at the time of surgery
- More crucial in complicated cases
 - Extractions or segmented osteotomies make prediction of final occlusion more difficult

Potential Problems

- Predicting the final occlusion is difficult due to multiple dental interferences
- Extraction cases are much more difficult to plan
- Surgical errors can complicate the final occlusion
- Treatment planning process is longer
- Increased number and complexity of osteotomies poses a greater risk to patient

Stability after surgery-first approach

- Stability following surgery-first approach compared to conventional technique found no significant different
- Parameters that affect long-term stability:
 - o Large overjet
 - o Deeper curve of spee
 - o Greater negative overjet
 - o Greater mandibular setback

Conclusion

- Surgery-first approach has the advantage of shortened treatment time, and early correction of facial deformity, early response to patient's needs
- There are limitations including proper case selection
- Proper diagnoses, treatment planning and simulation of correction is required
- Experienced surgeon and orthodontist is important to apply the appropriate treatment method to meet the patient's needs and goals

References

Sharma VK, Yadav K, Tandon P. An overview of surgery-first approach: Recent advances in orthognathic surgery. J Orthod Sci. 2015; 4(1)2-12.