

SURGERY FIRST APPROACH: PARADIGM SHIFT IN ORTHOGNATHIC SURGERY

Naveena kumar¹, Harsh Umesh Sharma², Afaque Siddiqui³, Amol Hedao⁴

1. Assistant Professor, Dept. of Orthodontics and Dentofacial Orthopaedics, AJ Institute of Dental Sciences, Mangalore, India.

2. Consultant Orthodontist, Private Practice, Mumbai, India.

3. Consultant Oral and Maxillofacial Surgeon, Private Practice, Mumbai, India.

4. Assistant Professor, Dept. of Oral and Maxillofacial Surgery, Hazaribagh Dental College and Hospital, Hazaribagh, India.

ABSTRACT:

The conventional approach towards treatment of a skeletal facial deformity starts with pre-surgical orthodontic treatment, followed by orthognathic surgery and eventually, post-surgical orthodontics. Pre-surgical orthodontics, though considered essential for adequate and stable surgical outcome, involves varied amount of time and temporary worsening of the facial esthetics, which proves to be a discouragement for many patients. Advancement in surgical techniques coupled with increase in number of patients seeking orthognathic surgery, a new treatment approach called as SURGERY FIRST (SFA), followed by orthodontic treatment has become very common. This approach, with its lesser treatment time and adequate effectiveness, has gained popularity in recent times.

Keywords: SFA, Surgery First, Orthognathic Surgery.



INTRODUCTION:

Skeletal deformities require surgical intervention for correction of both form and function. The classic approach involves an initial phase of pre-surgical orthodontics which includes leveling and aligning the arches, relieving crowding, creating proper inclination of incisors (decompensation), coordinating upper and lower arches and removing occlusal interference.^[1] It is believed that non-decompensation of dentition prior to surgery affects the surgical outcome as well as stability. The average time taken is 6 months to 2 years to create an ideal pre-surgical occlusion.^[2,3] Apart from being the longest period of the whole treatment, pre-surgical orthodontics can also cause aggravation of dental caries

and periodontal problems, worsening occlusal function and deteriorating facial esthetics, especially in class III patients.^[1,2]

Orthognathic surgery was first performed by Hüllihen in 1848. Since then, many new techniques and advancements have been introduced in the field of orthognathic surgery. As shown by Kondo and Aoba, the limits of orthodontic treatment alone to severe malocclusions are broadening, but the underlying skeletal imbalances remain.^[4,5] The shortcomings associated with this traditional approach has given rise to a new concept called SURGERY FIRST orthognathics.

This concept was introduced by Brachvogel in 1991, with the goal of reducing some of the disadvantages and

*Corresponding Author Address: Dr. Harsh Umesh Sharma, Consultant Orthodontist, Private Practice, Mumbai, India.
Email: harsh_umesh@rediffmail.com

inconveniences of pre-surgical orthodontics. He claimed that during post-surgical orthodontics, dental movement can be achieved on corrected skeletal base without interfering with the compensatory biological response, thereby minimizing relapse after treatment.^[6] In recent times, this novel treatment concept is being followed widely in USA, Korea, Japan, and Taiwan.

SURGERY FIRST APPROACH

Skeletal anchorage forms the basis of this technique. It involves using titanium miniplates for rigid fixation of bony segments that helps to direct orthodontic forces for three dimensional movements in adult patients. The reduced treatment time has been a major factor in success of the surgery first approach. It has been shown that orthodontic treatment time decreases by using alveolar osteotomy procedures.^[7,8] This can be attributed to increased cortical bone porosity after mechanical alteration of bone, resulting in decreased resistance to tooth movement. It has been shown that during the healing process after orthognathic surgery, there is an increase in blood flow above the pre-surgical levels.^[9] The increase in blood flow facilitates the healing process and stimulates bone turnover which can potentially speed up orthodontic tooth movement.

Surgery first approach is a complicated technique that requires teamwork and cooperation between an experienced orthodontist and orthognathic surgeon. Prediction of the desired final occlusion is a very difficult task. Also, the surgeon must be able to arrange the skeletal components

to match the predicted skeletal positions and occlusion precisely. Therefore, precise diagnosis and treatment planning is of utmost importance while employing this approach. The advent of computer assisted surgical simulation and advanced computed tomography techniques have greatly contributed to the success of this technique.^[10]

INDICATIONS

A variety of cases can be treated under this approach. Though, certain criterias make it easy to follow this approach.^[11] They are :

- Mild to moderate crowding
- normal to mild proclination / retroclination of upper and lower incisors,
- minimal transverse discrepancies
- nearly flat curve of spee
- Class III skeletal malocclusions (as they show greater soft tissue imbalance in comparison to class II)

ADVANTAGES OF SURGERY FIRST CONCEPT

1. Patients undergoing orthognathic surgery often complain of poor aesthetics. During conventional three stage approach of orthognathic surgery, the facial appearance worsens during decompensation and improvement in facial aesthetics occurs during the end of the treatment. Whereas, in the surgery first approach, this complaint can be addressed during the initial part of treatment by eliminating the unsightly pre-surgical

profile; thereby, enhancing patient compliance and satisfaction.

2. Surgery first approach shortens the treatment time. Treatment times as short as seven months have been reported in the literature.^[12] The pre-surgical orthodontic phase in conventional three-step orthognathic surgery cases is the most time consuming step. Bypassing this step results in an overall shortened treatment time to 1 to 1.5 years or less.^[11]
3. There is immediate correction of soft tissue and skeletal disturbance in surgery first approach. In conventional approach, the orthodontist tries to bring about a pre-surgical stable occlusion which is against the skeletal and soft tissue structures present and then surgery is done to correct skeletal and soft tissue imbalance. This leads to greater chances of relapse post-treatment. In surgery first approach, this factor is eliminated as occlusion is achieved post surgically.^[13]
4. Improved cooperation of the patient during orthodontic treatment,

SHORTENED TREATMENT DURATION IN SURGERY FIRST ORTHOGNATHICS: REGIONAL ACCELERATORY PHENOMENON (RAP)

First described by Frost in 1993, RAP is seen both in conventional orthognathics as well as surgery first orthognathics. Post-surgery, bone remodelling around the healing tissue facilitates the healing process. This period

of accelerated activity can be utilized by the orthodontist to maximize tooth movement. After osteotomy, this period of rapid metabolic activity can be managed to bring about optimum dento-alveolar movement and decompensation unlike the traditional approach where, initially time consuming decompensation is achieved prior to surgery. This way RAP can be used when it is most needed and can be maximally utilised. Alkaline phosphatase (ALP) and C-terminal telopeptide of type I collagen (ICTP) are two bone markers which have been studied using 22 patients of SFA. The former is associated with osteoblastic activity while the latter is a by-product of osteoclastic breakdown of bone. The results of such study show that orthognathic surgery triggers 3–4 months of higher osteoclastic activities and metabolic changes in the dentoalveolus.^[11]

TREATMENT PLANNING GUIDELINES

Correct diagnosis and treatment planning dictates the success of orthognathic surgery especially in surgery first approach, where multiple treatment planning considerations are taken into account. Following points should be considered:

- One week prior to orthognathic surgery, upper and lower dentitions are bonded and banded. Literature varies on pre-surgical placement of arch wire. Case reports by Chung et al.^[14] favour placement of NITI arch wires, while Nanda et al. suggest placement of NITI wire after soft tissue closure followed by stainless steel wires after 2 weeks.^[12] Orthodontic arch wires are placed

1-week to 1-month postoperatively for the alignment, whereas the osteotomized jaw bones are held steadily by the rigid fixation.

- Model surgery is performed by mounting the maxilla and mandible using molar relationship to achieve INTENDED TRANSITIONAL OCCLUSION (ITM). The ITM must be stable enough to allow predictable splint fabrication and skeletal movement.¹⁵ For e.g.: In a Class III skeletal malocclusion after surgery, a Class I or II malocclusion with the characteristic dental compensations of a Class III malocclusion is established. The decompensation of the teeth is performed following surgery.
- Inclination of incisors determines the need of possible extractions. If upper incisors to occlusal plane angulation

is less than 53°-55°, then extractions must be considered.^[11]

- Transverse dimensions must to be maintained. Midlines should be coincident and optimal buccal overjet should be achieved.

PROTOCOL VARIATIONS

The protocol for treatment varies according to the orthodontist and orthognathic surgeon. Though the sequence of treatment remains the same but different clinicians follow their customized preferences in preparing the patient for surgery, performing the surgery and starting the orthodontic treatment. Various Protocols followed around the world are summarized in table 1.

TABLE 1

| PROTOCOL | VARIATION |
|----------------------------|----------------------------------------------------------------------------------|
| Pre-surgical Arch Wires | Passive stainless steel wires, NITI wires, no wires |
| Bracket size | 0.022 brackets, 0.018 brackets, no brackets (wire directly bonded on the teeth) |
| Splints | Only during surgery, 2-4 weeks after surgery, no splints |
| Post-surgical Orthodontics | After 1 month, after 5-7 weeks |

SKELETAL ANCHORAGE IN SURGERY FIRST APPROACH

The success of SFA lies in meticulous treatment planning and collaboration between Orthodontist and Orthognathic

surgeon. Skeletal anchorage forms the backbone of SFA. It not only helps as a back-up for orthodontist during post - surgical orthodontic phase, but also, provides three-dimensional control for postsurgical correction of any relapse tendencies or slight discrepancies between the planned and actual surgical outcomes. It varies from

mini implants to titanium miniplates which are placed during surgery.

DRAWBACKS OF SURGERY FIRST APPROACH

- Prediction of final occlusion is tough due to dental interferences.
- Requires experienced orthognathic surgeon and orthodontist as any minor surgical error can lead to can compromise the result and/or its stability.
- Treatment planning process is time consuming.
- The increase in the number and complexity of osteotomy procedures poses a greater risk to the patient.

STABILITY OF SFA

Various studies suggest that orthodontic first approach shows no greater stability benefits than SFA.^[16,17]

REFERENCES:

1. Proffit WR, White RP, Sarver DM. Combining surgery and orthognathics: Who does what, when? In: Proffit WR, White RP, and Sarver DM, eds. Contemporary Treatment of Dentofacial Deformity. 1st ed. St. Louis, Missouri: Mosby, 2003:245-67.
2. Dowling PA, Espeland L, Krogstad O, Stenvik A, Kelly A. Duration of orthodontic treatment involving orthognathic surgery. Int J Adult Orthodon Orthognath Surg 1999; 14:146-52.
3. Luther F, Morris DO, Hart C. Orthodontic preparation for orthognathic surgery: how long does it take and why? A retrospective study. Br J Oral Maxillofac Surg 2003; 41:401-6.
4. Kondo E, Aoba TJ. Nonsurgical and nonextraction treatment of skeletal class III open bite: Its long-term stability. Am J Orthod Dentofacial Orthop 2000; 117:267-87.
5. Kondo E, Arai S. Nonsurgical and nonextraction treatment of a skeletal class III adult patient with severe prognathic mandible. World J Orthod 2005; 6:233-47.
6. Brachvogel P, Berten JL, Hausamen JE. Surgery before orthodontic treatment: A concept for timing the combined therapy of skeletal dysgnathias. Dtsch Zahn Mund Kieferheilkd Zentralbl 1991; 79:557-63.

Recently, study was carried out to identify parameters for instability in SFA and concluded that factors for instability are large overjet, a deeper curve of Spee, a greater negative overjet and greater mandibular setback.^[18]

CONCLUSION

Taking into consideration the expertise and capability of orthognathic surgical team, Surgery First approach provides a viable alternative to the conventional orthognathic treatment. Reduced treatment time along with early improvement of facial aesthetics, form and function can be achieved by this novel approach.

7. Wilcko WM, Wilcko T, Bouquot JE, Ferguson DJ. Rapid orthodontics with alveolar reshaping: Two case reports of decrowding. *Int J Periodontics Restorative Dent* 2001; 21:9-19.
8. Wilcko MT, Wilcko WM, Pulver JJ, Bissada NF, Bouquot JE. Accelerated osteogenic orthodontics technique: A 1-stage surgically facilitated rapid orthodontic technique with alveolar augmentation. *J Oral Maxillofac Surg* 2009; 67:2149-59.
9. Justus T, Chang BL, Bloomquist D, Ramsay DS. Human gingival and pulpal blood flow during healing after Le Fort I osteotomy. *J Oral Maxillofac Surg* 2001;59:2-7.
10. Hsu S, Singhal D, Xia J, Gateno J, Lin CH, Huang CS, et al. Planning the surgery-first approach in surgical-orthodontic treatment with a computer aided surgical simulation (CASS) planning protocol. *J Taiwan Assoc Orthod* 2012;24:24-37.
11. Liou EJ, Chen PH, Wang YC, Yu CC, Huang CS, Chen YR. Surgery-first accelerated orthognathic surgery: Orthodontic guidelines and setup for model surgery. *J Oral Maxillofac Surg* 2011;69:771-80.
12. Villegas C, Uribe F, Sugawara J, Nanda R. Expedited correction of significant dentofacial asymmetry using a "surgery first" approach. *J Clin Orthod* 2010;44:97-103.
13. Baek, S.H.; Ahn, H.W.; Kwon, Y.H. & Choi, J.Y. Surgery First Approach in Skeletal Class III Malocclusion Treated with 2-Jaw Surgery: Evaluation of Surgical Movement and Postoperative Orthodontic Treatment. *Journal of Craniofacial Surgery* 2010;21(3):332-338.
14. Yu CC, Chen PH, Liou EJ, Huang CS, Chen YR. A Surgery-first Approach in Surgical-orthodontic Treatment of Mandibular Prognathism – A Case Report. *Chang Gung Med J* 2010;33:699-705.
15. Park, S.; Hyon, W.L.; Lee, J.G.; Lee, S.; Lee, Y. & Shin, S. (2011). Increasing Efficiency and Improving Patient Compliance/Affordability/Orthognathic Surgery with Surgery First Orthognathic Approach (SFOA). Abstract from Proceedings of the 3rd William H. Bell Lectureship Symposium, "Accelerated Orthognathic Surgery and Increased Orthodontic Efficiency," March 18-20, 2011, Houston, Texas.
16. Wang YC, Ko EW, Huang CS, Chen YR, Takano-Yamamoto T. Comparison of transverse dimensional changes in surgical skeletal Class III patients with and without presurgical orthodontics. *J Oral Maxillofac Surg* 2010;68:1807-12.
17. Liao YF, Chiu YT, Huang CS, Ko EW, Chen YR. Presurgical orthodontics versus no presurgical orthodontics: Treatment outcome of surgical-orthodontic correction for skeletal class III open bite. *Plast Reconstr Surg* 2010;126:2074-83.
18. Ko EW, Hsu SS, Hsieh HY, Wang YC, Huang CS, Chen YR. Comparison of progressive cephalometric changes and postsurgical stability of skeletal Class III correction with and without presurgical orthodontic treatment. *J Oral Maxillofac Surg* 2011;69:1469-77.