"Surgery First Approach-Revolutionizing Treatment Strategies": A Review Article

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Abstract:
Variations in the skeletal, dental, and surrounding soft tissues interaction lead to skeletal malocclusions. Orthognathic surgery and orthodontics must be used in conjunction to treat these malocclusions in adults. Orthodontists and surgeons refer to the technique for orthognathic surgery without presurgical orthodontic treatment as the "surgery-first approach" (SFA).1 SFA has become increasingly popular in the last few decades because of the high number of young individuals undergoing cosmetic surgery. Due of the prolonged recovery period associated with traditional orthognathic surgery, the surgery first orthognathic approach (SFOA) was developed.2, 3 in this approach, orthodontic treatment is administered to settle the occlusion and align the teeth after orthognathic surgery. The implementation of a surgical first approach triggers the Regional Acceleratory Phenomenon (RAP), an important factor in reducing the total duration of treatment.3, 4 the purpose of this article is to give a general overview of the SFOA's history, indications, benefits, drawbacks, treatment planning considerations, mounting and setup procedures, regional acceleratory phenomena, stability, and future.

Keywords: Surgery first approach, conventional orthognathic surgery, skeletal malocclusion, regional acceleratory phenomenon

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INTRODUCTION:

In modern society, facial beauty is regarded as an important feature. Surgical orthodontics is the art and science of integrating orthodontics and oral and maxillofacial surgery to repair musculoskeletal, dentoalveolar, and soft tissue abnormalities of the jaws and associated structures. Hullihen created the phrase "orthognathic surgery" in 1849, when surgical operations in orthodontics were rare.[1, 2]

Until the 1960s, pre-surgical orthodontic preparation for patients requiring orthognathic surgery was uncommon. It takes a long time to complete this process. To address the drawbacks and inconveniences of presurgical orthodontics, Behrman and Behrman introduced the surgery first orthognathic approach in 1988. Other issues include worsening of the facial profile, masticatory discomfort during presurgical orthodontic treatment, and psychosocial problems related to the delay in attending to the patient's complaint. Additionally, because of the long-term orthodontic preparation, there may be complications such as dental caries, gingival hyperplasia, and root resorption.[3, 4]

The surgical method is being used more often because of the growing desire for flawless immediate aesthetics. When orthognathic surgery was first carried out, maxillary or mandibular movement was restricted because orthodontic treatment was not

provided.5, 6 consequently, to achieve the proper setback and maintain good facial and occlusal esthetics, surgeons understood that misaligned teeth needed to be orthodontically straightened before surgery. Many surgeons started integrating orthodontic treatment with orthognathic surgery in the 1970s. Overcoming the forces of natural compensation is the primary goal of presurgical orthodontic treatment.7, 8

Surgery First Approach:

The surgery-first method prioritizes facial aesthetics over occlusion, whereas the conventional technique prioritizes occlusion over facial aesthetics. The surgery-first method creates a "transitional occlusion postoperatively" by using osteotomy to address skeletal issues as well as dental compensation.9

But given that a skeletal discrepancy is the primary cause of the dentofacial deformity being treated with orthognathic surgery, one may wonder, why not address the skeletal discrepancy first, as it is the underlying cause of the dentofacial deformity? This makes sense and seems reasonable. The requirement to resolve postoperative occlusal instability, however, presents a challenge.10, 11

The SFOA technique is essentially a "face-first" strategy in which the primary complaint of the patient is addressed right away by enhancing the soft tissue profile of the face, which in turn increases the patient's compliance with the course of treatment.

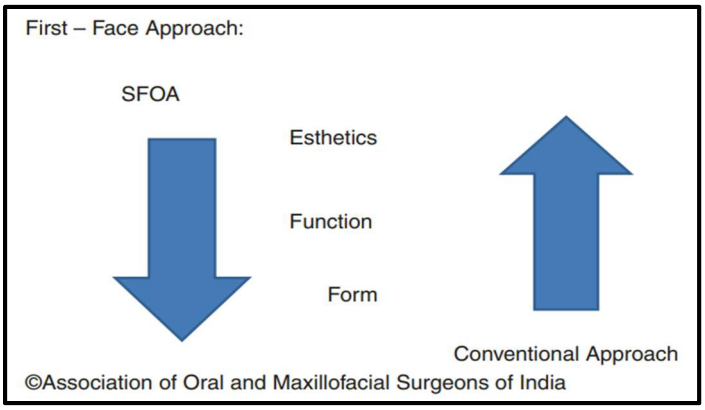

Fig. 1: The flow diagram demonstrating fundamental differences and the order of priority between the SFOA and conventional approach.

Due to the localized acceleratory effect, the surgical line produces higher bone turnover in a comparatively shorter amount of time, allowing the patient to recognize the enhanced facial appearance more quickly. SFA is widely utilized in Asian nations like Korea and Japan.[12]

Advantages of the SFA:

1. The potential for a shorter overall treatment duration
2. There is absolutely no need for an exaggeratedly unattractive appearance in the pre-surgical orthodontic phase.
3. Very little interference with the patient's social life
4. A patient-centered methodology; prompt enhancement of facial aesthetics
5. A productive surgical and orthodontic schedule with adequate recovery time to address skeletal and facial alterations.[13]

Disadvantages of the SFA

According to certain researches, the mandibular counter clockwise rotation is less predictable when using the SFA, and it can be challenging to apply the SFA to severe transverse deficiency. Below is a summary of the SFA's potential drawbacks. –

1. A lengthy dental set-up simulation needed for surgical occlusion.
2. More precise and delicate procedures for surgical treatment objectives.
3. The requirement for knowledgeable and precise decision-making when determining if SFA is feasible.
4. The surgical archwire requires complicating wire bending.
5. Third molar extraction is not possible prior to surgery.
6. An extended duration of intermaxillary bone fixation may be required.
7. Imperfect lip and facial profile right after surgery.
8. Chewing issues resulting from an incomplete occlusion right after surgery.

Indications:

In several situations, the initial approach to dentofacial deformity surgery is recommended based on the specific features of the malocclusion. The following are some characteristics of the malocclusion[14]:

1. Properly aligned to slightly crowded front teeth
2. Incisor inclination, normal to slight proclined/retroclined
3. Curve in spee ranging from flat to mild
4. Minimal discrepancies in the transverse plane.
5. A noticeable imbalance in soft tissues in individuals with skeletal class III.
6. Situations where decompensation is not necessary.
7. Individuals seeking instant aesthetic improvement or those seeking to enhance both appearance and functionality.
8. At least three stable occlusal stops, six anterior teeth in a positive overbite, and arch coordination.
9. The patients must be of the correct age to have surgery.

Contraindications:

The following situations make it undesirable to use a surgical first approach:

1. Individuals in need of specific decompensation
2. Severe crowded conditions and poor arch-coordination
3. Severe discrepancy in vertical or horizontal orientation
4. Patients who anticipate excellent dental aesthetics and stable occlusions from their treatments.
5. The upper and lower anteriors exhibit severe proclination.[15]

The difficulties with the traditional "orthodontics-first" method

1. Time-consuming
2. Facial shape deterioration
3. Difficulty masticating or chewing during the preparatory period
4. Psychosocial issues
5. Other issues such as root resorption or injury, gum recession, and tooth decay.

Comparision:

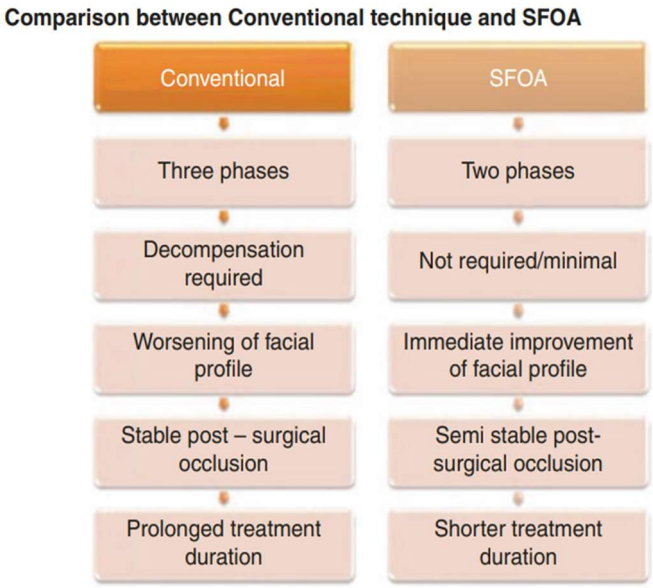

Fig. 2: The comparison chart demonstrating various steps for conventional technique and SFOA

Treatment Planning Considerations:

Every orthognathic surgery case requires careful preparation, particularly if the operation is to be done before orthodontic treatment. After surgery, teeth will decompensate to their normal placements and angulations, so the transitional occlusion needs to accommodate for this movement.

1. In surgery first cases, the molar relationship is employed as a starting point to determine a temporary occlusion because the incisors cannot be used as a reference to forecast the final occlusion.
2. When assessing whether extractions are necessary, the inclination of the upper incisors is important.
3. To enable post-operative upper incisor retraction, extractions may be undertaken if the upper incisor is severely proclined.[3, 16]
   The transverse dimension of the arches often prevents correct interdigitation postoperatively when putting the upper and lower models into occlusion.

4. After surgery, appropriate buccal overjet must be achieved bilaterally, and the midlines must coincide or be near them.

The hardest and longest part of getting ready for surgery-first orthodontics is predicting the final occlusion based on the teeth's existing positions. The occlusion that serves as the surgeon's guidance during surgery and is used to create the surgical splint is known as intended transitional malocclusion, or ITM.[3, 17]

When choosing the ITM, the upper and lower models need to make at least three points of contact, and the molar relationship can be used as a starting point to guide temporary occlusion. When a temporary occlusion cannot be established, orthodontic movement should be started to ease some of the interferences. Depending on whether the vertical issues are connected to dental interferences that are not fixed prior to surgery, they should be treated with postoperative orthodontic treatment or posterior maxilla impaction. Vertical problems are typically related to anteroposterior abnormalities.[17]

In class II Division 1 Malocclusions:

Patients in class II who have retrusive mandibles are likely to benefit most from SFOA. Following mandibular advancement, class II malocclusion creates a super class I or class III relationship immediately following surgery, with an edge-to-edge incisor relationship or bimaxillary dentoalveolar protrusion. Therefore, to address this problem, class III orthodontic mechanics must be used. Alternatively, like in class I bimaxillary protrusion situations, all first premolars can be extracted and then retracted.[18, 19]

In class II Division 2 Malocclusions:

It is challenging to perform SFOA in class II division 2 situations since there is less overjet. In these circumstances, either presurgical orthodontics can be used to obtain reverse overjet, which will allow for the advancement of the mandible to repair the skeletal deformity, or the SFOA operation can be carried out immediately without the need for orthodontics.[18, 19]

In class III Malocclusions:

When surgery is carried out first, class III malocclusion typically transforms into a class II relationship right after the mandibular setback. This class II relationship should be maintained with a surgical splint and necessitates class II orthodontic mechanics following surgery, with anterior teeth adjustment being managed postoperatively.[20]

Treatment Ideas using SFOA for Asymmetric Malocclusions:

One of the main characteristics of an attractive face is symmetry. Surgical intervention is typically necessary to address skeletal asymmetries to improve facial aesthetics and rectify any related malocclusions. The traditional method divides orthodontic treatment into two phases: the presurgical phase eliminates dental compensations, and the postsurgical phase refines the occlusion. Today, presurgical orthodontic phases can be eliminated, small surgical errors can be fixed, and patients can benefit aesthetically from SFOA. To address the asymmetry in these patients, SFOA incorporates asymmetrical single-jaw surgery.[21]

Procedures for Mounting and Setting up Models in SFOA

- Following the completion of the diagnostic and treatment planning, bite registration and standard model mounting are carried out with impressions taken to closely examine the current condition of the occlusion.
- Teeth that have naturally compensated for the current skeletal disparity are simulated in the model setup and rearranged into the expected occlusion, which is comparable to the preoperative orthodontic treatment plan. To achieve the intended preoperative occlusal relationship, all the teeth on the set-up model are rearranged as though orthodontic treatment were being performed on a real patient using traditional orthognathic surgical techniques.

The extent of skeletal movement needed in the maxilla, mandible, or both will be apparent once the models are in the ideal dental occlusion. Next, using the mounted models, a typical technique is used to

simulate the actual orthognathic surgery. This will show the possibility of an occlusal result of using the conventional method.

- After setting up these mounted models into the intended skeletal movements, intermediate and final splints can be created.
- With the development of virtual planning and three-dimensional simulation software, it is now possible to print the three-dimensional intermediate and final splints and execute the same set-up model surgery by scanning the physical models and feeding registration information into the software.[22]

Procedures for Surgery:

The mentioned standard techniques, whether they be the conventional approach or the SFOA technique, are used to perform the surgical procedures in the maxilla, mandible, or chin.

Conventional technique	SFOA technique
1. Initial diagnosis	1. Initial diagnosis
2. Surgical planning—STO	2. Surgical planning—STO
3. Pre surgical orthodontic treatment	**3. Simulation of pre-surgical orthodontic treatment**
	Model mounting and model setup
	4. Simulation of orthognathic surgery
4. Surgical arch wire	5. Surgical arch wire
5. Fabrication of splints	6. Fabrication of splints
6. Orthognathic surgery and post-op care	7. Orthognathic surgery and post-op care
7. Orthodontic rediagnosis	8. Orthodontic rediagnosis
8. Orthodontic treatment	9. Orthodontic treatment
9. Finishing	10. Finishing

Fig. 3: Treatment protocol comparing SFOA technique to conventional technique

Reduced Treatment Time In Surgery-First Approach: Regional Acceleratory Phenomenon:
Frost (1993) presented an explanation of the regional acceleratory phenomena. Following an osteotomy, the healing process is aided by bone remodeling surrounding the healing tissue. Two bone indicators, alkaline phosphatase (ALP) and C terminal telopeptide of type I collagen (ICTP), have been investigated in 22 SFA patients.
The former is linked to osteoblastic activity, whereas the latter is a by-product of bone degradation caused by osteoclastic activity. According to the study's findings, orthognathic surgery causes the dentoalveolus to undergo increased osteoclastic activity and metabolic alterations for three to four months. Following orthognathic surgery, there is a brief spike in bone turnover and remodeling activity, as seen by the postoperative transient elevation in ICTP and ALP.[23, 24]

The Future of "Surgery-First" Approach:
The use of virtual orthodontic setup, which replaces the mounted study model setup, enhanced skull models, and computer-aided design and manufacturing for the creation of intraoperative splints are the key components of the SFOA technique's future.
The orthodontist will be able to forecast each tooth's final location and axial inclination more accurately with the aid of the 3D virtual orthodontic set-up. With the patient's prevailing occlusion in a compensated state, it cannot be used as a guide for skeletal relocation, making this a compelling step prior to the surgeon's skeletal base correction simulation. One aspect that can contribute to the future of SFOA is the usability of interdental corticotomies and temporary anchoring devices (TAD).
By preventing early bracket loading with subsequent problematic tooth extrusion, the TAD allows a broader variety of orthodontic vectors. Interdental corticotomies have the potential to increase RAP and lengthen the orthodontic treatment period.[24, 25]
Stability:
Several investigations comparing the stability of SFA with a traditional method revealed no discernible differences. Transverse alterations have also been compared, and there is no discernible difference between the groups with and without presurgical orthodontics.[26, 27] in cases of malaligned dental arches, the surgeon should be able to conduct

specified osteotomy, intermaxillary fixation with an occlusion bite plate, and provide stability following skeletal realignment.[28]

Postoperative occlusal instability in patients undergoing surgery-first orthodontic treatment is mostly caused by the upper second molar's extrusion. Premature contact also causes greater vertical dimension, forward mandibular displacement after surgery, and postoperative occlusal instability.

In an investigation by Ching et al. comparing postsurgical stability of skeletal class III malocclusion with and without presurgical orthodontic therapy, there was a higher rate of recurrence (27.8% ±4 mm) in the SFOA group.[29, 30]

But following surgery-first orthodontic therapy, occlusal instability can be managed with a surgical stent. By preventing the proximal segment's clockwise rotation and maintaining the distal segment's medial pterygoid and masseter muscles to prevent recurrence, surgical precision can be increased by using 3-dimensional prediction and surgical wafer printing.[31]

CONCLUSION:

One special benefit of performing orthognathic surgery prior to any orthodontic tooth movement (SFOA) is that it can address the patient's primary complaint right away, which will increase the patient's acceptance and compliance with the entire treatment plan. By using the RAP, it also provides the considerable benefit of a reduction in overall treatment duration. When employing orthodontics-first and surgery-first strategies, the ultimate results are comparable in terms of face aesthetics, dental occlusion, and stability.

But it is important to keep in mind that both the orthodontist and the surgeon must proceed with caution because patient selection is crucial. They should also work together as a team during the whole treatment process, from diagnosis to debonding.

The surgical orthodontist team must be aware of the fundamentals of orthodontics, comprehend the boundaries of orthodontic tooth movement, and account for dental decompensation in their initial treatment planning.

After the skeleton is realigned, the surgeon should be able to perform a specified osteotomy, intermaxillary fixation with an occlusion bite plate, and provide stability. Orthognathic surgery's future is focused on shortening treatment times overall without sacrificing results.

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