



SURGERY FIRST ORTHOGNATHIC APPROACH (SFOA) - A REVIEW

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Abstract:

Orthognathic Surgeries are being carried out in adults who need treatment for their dentoskeletal deformities. A good surgical planning should be there when moving forward to Orthognathic surgeries. The Conventional Orthognathic Approach (COA) has three phases- Pre- Surgical Orthodontic Phase, Skeletal Surgical Correction and Post- Surgical Orthodontic Phase. An alternate surgical approach raised during early 2000s. The rise of SFOA has lately became popular among Orthodontists. The SFOA bypasses the Pre- surgical orthodontic phase and directly enters to the skeletal surgical correction phase. By this, there's a reduction in treatment duration and provides early improvement in the facial esthetics. The SFOA uses the Regional Acceleratory Phenomenon and the natural forces from soft tissues to bring down the treatment duration to significantly lesser than that of conventional orthognathic approach

Key words: Surgery First Orthognathic Approach, Conventional Orthognathic Approach, Dentoskeletal deformities, Reduction in treatment duration

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Introduction:

Surgery first orthognathic approach (SFOA) has gained popularity in the field of orthodontics.

Orthognathic surgery is one of the best treatment choice for correction of various dentofacial deformities. The first orthognathic surgery

procedure was performed by Hüllihen in 1848 with many new techniques and newer methods¹. Kondo and Aoba insisted orthodontic treatment alone to correct severe malocclusions where skeletal malocclusion remains untreated. Brachvogel et al in 1991 proposed the concept of “surgery-first and orthodontics second”^{2,3}. The goal of the treatment settle the teeth and soft tissue into better position after surgery facilitating remaining orthodontic tooth movement and reducing the total orthodontic treatment period⁴. In Conventional orthognathic surgery (COS), presurgical orthodontics done to lessen the dental crowding, level the curve of Spee, decompensate the dental inclinations, remove any occlusal interferences and coordinate the upper and lower arches. Major drawback related to COS are prolonged treatment duration, gingival recession, gingival hyperplasia, dental caries, root resorption, deterioration in occlusal function, masticatory and speech discomfort and subsequent psychological problems due to delay in resolution of patients’ chief complaint^{5,6}. Furthermore, In presurgical phase there is a deterioration in the patients’ facial profile which lead to a negative impact on the quality of life⁷. Luther et al have reported an average duration of 17 months for presurgical orthodontics⁸, whereas Dowling et al and O’Brien et al have found the mean duration to be 15.4 months and 25 months, respectively^{9, 10}. PeiroGujjarro et al concluded a mean total treatment duration of 14.2 months with a range of 10.2-19.4 months for SFOA¹¹. This current review article discusses about all basic topics under SFOA.

Treatment Planning¹²

- A temporary occlusion can be created using the molar relationship as a starting point.
- The requirement for potential extractions must be determined in part by the inclination of the upper incisors. Extraction should be considered if the angle between the upper incisor and the occlusal plane is between 53 and 55 degrees.
- After surgery, the midlines must be coincident or relatively near to it, and a correct buccal overjet must be established on both sides.
- Most challenging and time consuming step is the prediction of the final occlusion based on the current position of teeth. The term intended transitional malocclusion is used to describe the occlusion that is used to fabricate the surgical splint and surgeon's guide during surgery. At least a three point contact must be established between the upper and lower models when deciding ITM. In cases where such temporary

occlusion cannot be established, it is advisable to initiate some orthodontic movement in order to relieve some of the interferences

Procedures in SFOA Treatment

SFOA can potentially produce semi stable postsurgical occlusion compared with the conventional orthognathic surgical approach because of its sequence without presurgical orthodontic treatment. Therefore, a rigid fixation after surgery has been suggested for maintaining the occlusion stability postoperatively. However, in this new treatment concept, the need of some of the orthodontic procedures are eliminated; some are displaced by maxillary posterior impaction (MPI), occlusal plane rotation (OPR), anterior segmental osteotomy (ASO), or segmental surgery and the other procedures are performed after an orthognathic surgery. Moreover, in order to predict the degree of post-operative orthodontic treatment, a set-up model is fabricated at a dental lab. While the sequence of treatment is similar, different protocols are being used to prepare the patient for surgery, perform the surgical procedure, and initiate orthodontic treatment.

Pre-surgical Procedures:

This includes timing of bonding in SFOA, stabilizing/ initial arch wires, splints, laboratory procedures.

Timing of bonding in SFOA: According to Sugawara¹² and Nagasaka¹³. Even when adopting a surgery first approach, fixed orthodontic appliances should be fitted soon before to surgery. But the issue is that when brackets are positioned on teeth right before surgery, their bonding power may be insufficient to withstand the force of intermaxillary fixation. Chung ChihYu¹⁴ Villegas¹⁵ recommended the brackets should be placed 1 week before orthognathic surgery. Ellen Wen ching¹⁶ recommended 1 month before surgery.

Stabilizing/ Initial arch wires in SFOA: Contrary to conventional orthognathic surgery cases, in surgery first treatments leveling and aligning have not yet been performed which makes it very difficult to place the wire. Most authors used stabilizing wires before surgery. Some used Ni Ti wires and some used stainless steel wires Before surgery, Liou et al. (17) did not place any orthodontic arch wires. 0.016x0.022" super elastic Ni Ti wire was used by Ching et al¹⁹. At the time of operation, 0.16"X0.16" nickel-titanium wires were chosen by Carlos et al¹⁹. After surgery, teeth

can move immediately because of the use of nickel-titanium wires, which can be beneficial. The orthodontist misses the chance to assess the stability of the surgical treatment before beginning the tooth movement. To prevent any tooth movement, Sugawara and Nagasaka^{12,13} recommended 0.18"x0.25" SS wires and 0.19"x0.26" SS wires in 0.022 slot, which are suitable to all teeth. The stresses brought on by intermaxillary fixation are absorbed by the full slot. Either brackets have hooks or brass wire (lugs) are soldered to the arch wire for wiring fixation, Kobayashi hooks can also be used¹⁵. Occasionally, intermaxillary screws may be required.

Splints in SFOA:

The use of surgical splint during and after surgery also varies between different orthodontists. While some advocate the use of the splint only during surgery, other groups have advocated its use anywhere between one to four weeks after surgery. Nagasaka et al¹³ have used removable Gelb-type splints post-operatively. Their preference is to leave the splint in for about 4 to 6 weeks after surgery and if an open bite is observed, to use elastic between the splint and the mini-screws or to leave the splint for a longer period of time. Sugawara et al¹² modified the surgical splint into a removable maxillary occlusal splint, which was used to stabilize the jaw position and masticatory function.

Laboratory procedures:

"Set-up models" are used to predict and simulate dental positions and arch coordination for decision on surgical jaw movement²⁰. Liou et al¹⁷ suggested to set-up model surgery in proper molar relationships with a positive overbite that is opposite to the conventional approach which uses decompensated incisors as the guide to predict the final occlusion. Moreover, they suggested how to set-up models in various circumstances. For example, a non-extraction case could be set-up with molar Class I relationship; in case of lower first premolar extractions, molars could be set up in Class III relationship; and set-up molars Class II in cases of maxillary first premolar extractions.

Surgical procedure:

In 2011, Liou et al²⁷ suggested specific guidelines for using SFOA to treat cases of skeletal Class III and skeletal Class II in three dimensions; vertical, sagittal and transverse. In vertical discrepancy, deep curve of Spee can cause occlusal interference because there has not been presurgical orthodontic correction. It has been suggested to treat some cases

with deep bite with subapical osteotomy, anterior segmental osteotomy or treat with postsurgical orthodontic appliance for correcting dental interferences. However, in applying the SFOA approach, the correction of the vertical discrepancy by anterior or posterior maxillary impaction can create anterior or posterior rotation of the mandible that will improve or worsen the profile of skeletal Class II or skeletal Class III. However, Baek et al²¹ suggested posterior maxilla impaction can decrease occlusal interference and increase the amount of mandibular backward rotation. Nagasaka et al¹³ and Sugawara et al¹² used removable surgical splints which consist of a lingual bar and ball-end clasps. Grinding of the occlusal surface of splint while using intermaxillary elastics can allow opposing teeth to be extruded and up righted. Whether the anterior part of splint has acrylic coverage depends on the orthodontist's need to prevent extrusion of incisors or allow anterior teeth eruption. For example, the Gelb type splint is suggested to maintain intrusion of posterior teeth because it has acrylic coverage over occlusal of posterior teeth only. This design will lead to mandibular upward and forward rotation and chin advancement.

Postoperative procedure in SFOA: The objectives of orthodontic treatment after surgery in the SFOA technique are dental alignment, arch coordination, and allow occlusal settling, that together might take another 6-12 months. This period can speed up orthodontic tooth movement especially after orthognathic surgery because there is an increased alveolar bone blood flow during the healing process with stimulation of bone turnover called the Regional Acceleratory Phenomenon²³. Leel as in jaroen et al²² suggested postsurgical orthodontic treatment could begin as early as one week to one month postoperatively. Kim et al²⁴ suggested to wait four to six weeks. The surgical splint and intermaxillary fixations should be removed for the tooth movement. Nagasaka et al¹³ completed postoperative orthodontic treatment within approximately 1 year. Sugawara et al¹² removed the fixed orthodontic therapy after 9 months. Villegas et al¹⁹ removed the fixed appliances 7 months after surgery. Treatment time was approximately 6-12 months shorter using a surgery-first approach compared with using a conventional orthodontics-first approach. Only one study¹⁵ described similar treatment times (approximately 1.5 years) for both approaches. The period for post-op inter-digitation is about 2-3 months. During this period, Orthodontists rapidly set the occlusion between upper and lower molars

and adjust the width of the molar areas. Risk management: The removal of wafer, immediate after orthognathic surgery may exhibit premature contact, difference among molar width etc. that might result in an open bite. Therefore, while patient wears the wafer, Orthodontists perform the occlusal splint adjustment and elastic wearing to the patient. Orthodontic treatment begins 2 weeks after the surgery.

Regional Acceleratory Phenomenon (RAP): The regional acceleratory phenomenon (RAP) was well described by Frost in 1989²⁵. After an osteotomy, bone remodeling around the healing tissue facilitates the healing process. This regional acceleratory phenomenon can be utilized by the orthodontist following orthognathic surgery to accelerate tooth movement. By performing surgery first, this period of rapid metabolic activity within the tissues can be harvested for efficient orthodontic treatment. In 2001, Wilcko et al²⁶ suggested that rapid tooth movement in the context of corticotomy-facilitated orthodontics was the result of a demineralization– remineralization process consistent with the wound healing pattern of the regional acceleratory phenomenon. It seems that selective bone injury results in an overwhelming activating stimulus for both catabolic and anabolic responses in the peridontium. It is possible that the alveolar bone adjacent to the osteotomies performed during orthognathic surgery also undergoes increased bone turnover. This could account for the more efficient postoperative orthodontic movements and hence contribute to the total treatment time reduction in a “surgery first” sequence. Serum alkaline phosphatase and C-terminal telopeptide of type I collagen are two bone markers which have been studied. The former is associated with osteoblastic activity while the latter is a by-product of osteoclastic breakdown of bone. The results of one such study show that orthognathic surgery triggers three to four months of higher osteoclastic activities and metabolic changes in the dentoalveolus²⁷.

Indications²⁸

- Well aligned to moderate crowding
- Flat to mild curve of Spee
- Normal to mild proclination/retroclination of incisors
- Minimal transverse discrepancy
- This approach is also indicated in cases in which decompensation is needed.

Contra indications²⁹

- Severe crowding
- Arch in-coordination
- Severe vertical or transverse discrepancy
- Patients with high expectations of treatment outcomes in terms of dental esthetics and stable occlusions.

Post- Surgical stability

The factors responsible for instability of SFOA are large overjet, a deeper curve of Spee, a greater negative overjet and greater mandibular setback³¹. Wang et al concluded that the final treatment outcome in both SFOA and COS were similar³². For sagittal plane, Kim et al have found greater relapse of around 2.4 mm in SFOA as compared to 1.6 mm in COS³⁰ whereas vertical plane, Liao et al have reported increased counterclockwise rotation¹⁶.

Conclusion

Performing orthognathic surgery before orthodontic treatment has multiple advantages like shortened treatment time, increased patient acceptance, and the utilization of the regional acceleratory phenomenon. By utilizing the principles of surgery first technique, the presurgical orthodontics period can be shortened even though if it is not eliminated³⁴. As with any other surgical procedure, the patient’s well-being and chief complaint should always be the first priority. The future of orthognathic surgery is geared toward minimizing the overall treatment time without compromising the final results.

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