Surgery First Orthognathic Approach Current Status

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Abstract: surgery first approach or SFOA is an alternate method to the conventional orthognathic surgery in orthodontics.one of the main benefits of this approach is removal of ugly looking decompensation phase. this approach makes use of phenomena called regional acceleratory phenomena (RAP) and natural forces to achieve greater reduction in treatment time. This article gives an overview of surgery first orthognathic approach (SFOA).

Keywords: Surgery first approach; SFOA; SFA; Jaw Surgery.

INTRODUCTION

A combined orthodontic and orthognathic surgery approach is accepted as the standard of care for patients who have a severe skeletal jaw discrepancy. Surgical orthodontic treatment traditionally involves presurgical orthodontic preparation, including dental alignment, incisor decompensation, and arch coordination. But some disadvantages have been recognized. One drawback is the long presurgical treatment time that typically worsens facial appearance and exacerbates the malocclusion. This can increase the total treatment time with no significant benefit for the patients. (*Proffit and White*) In some countries, these have caused patients to seek plastic surgeons to perform orthognathic surgeries without any consideration for occlusion. In order to solve those serious problems of traditional surgical orthodontic treatment, a new approach was adopted the first step is orthognathic surgery (OGS), which is followed by orthodontic alignment. This approach is named as Surgery First orthognathic approach (SFOA).

History: Conventional jaw surgery did originate sometime in the 18th century (1849) when an American oral surgeon, *Simon Hullihen* (considered as the father of oral surgery), first performed jaw surgery to correct a prognathic mandible. In 1944, Dingman reported cases receiving surgery before orthodontics. In 1954, J.B. Caldwell and G.S. Letterman devised a vertical osteotomy of the ascending ramus to allow for setback of the mandible followed by direct wire fixation. In 1957, two Austrian oral surgeons, *Richard Trauner* and *Hugo Obwegeser*, introduced sagittal split osteotomy, which then marked the foundation of the modern era of jaw surgery.1959 - Skaggs suggested that patients with minor dentition problems may receive surgery before orthodontic treatment. Obwegeser was the first to develop LeFort osteotomy to move the maxilla in all three dimensions in 1969. Behrman and Behrman in 1988 introduced the concept called as surgery first and orthodontics second i.e. first starting with surgery without any presurgical procedures and later on orthodontics treatment is done postoperatively. In 2003 Nagasaka et al proposed SFA at Tohoku University in sendai japan for patients with skeletal deformity.

INDICATIONS

The criteria that are suggested for Surgery First Approach are:

- Well-aligned to mild crowding.
- Flat to mild curve of Spee.
- Normal to mild proclination/ retroclination of incisors.
- Minimal transverse discrepancy.
- Pronounced soft tissue imbalance in skeletal class III patients.
- Severe class II deformities, where decompensation is not required.

- Even though, the surgery-first technique can be applied to Class II as well as Class III malocclusions, the majority of cases treated using this approach have been cases with Class III malocclusion meeting the above criteria.

CONTRAINDICATIONS

- Patient who require definite decompensation
- Severe crowding
- Arch-incoordination
- Severe vertical or transverse discrepancy
- Patients with high expectations of treatment outcomes in terms of dental aesthetics and stable occlusions.
- Severe proclination of upper and lower anteriors.

Advantages:

- Immediate change in facial profile.
- Improved cooperation of patient.
- Reduce treatment time.
- Elimination of ugly looking decompensation phase.

Disadvantages:

- Predicting the final occlusion is hardest with SFOA.
- Cases needing extraction are difficult to plan with surgery.
- Any minor discrepancy can compromise the final results

Classification:

SFOAs can be classified into two different styles.

1. The orthodontic-driven style/Sendai approach.

Skeletal problems are solved by surgery, and Dental problems are fixed orthodontically.Also referred to as Sendai approach. This approach is possible because the skeletal anchorage system (SAS) biomechanics provide us with the ability to predictably control the three- dimensional movement of the bimaxillary molars.

However, some of the drawbacks of this technique are overreliance on SAS, post-surgical complex orthodontic tooth movement, added cost of SAS, and additional surgical intervention for removal of SAS post-treatment

2. The surgery-driven style.

The aim is to solve both skeletal and dental problems by orthognathic surgery (OGS) as much as possible.

Protocols in SFOA:

As surgery first orthognathic approach (SFOA) does not involve presurgical orthodontic treatment, it can produce semistable postsurgical occlusion compared to conventional surgery. Therefore a rigid fixation after surgery is mandatory in SFOA.

1. Pre surgical procedures
2. Surgical procedures
3. Post-surgical procedures

Pre-surgical procedures:

In SFOA, the pre-surgical orthodontic stage is reduced to minimal orthodontics where brackets are bonded but minimal or no orthodontic tooth movement is carried out Orthodontic Appliances (Brackets and Arch Ligation)All SFOA practitioners (both orthodontist and surgeons) have their own individual technique and treatment philosophies that suit them as a team.

Timing of bonding Sugawara and Nagasaka recommended that fixed orthodontic appliances should be placed just before surgery even when using a surgery first approach. But the problem is, when brackets are attached immediately before surgery the bond strength of bracket to teeth might be weak and fail to resist the force of intermaxillary fixation. Chung et. al.. recommended the brackets should be placed 1 week before orthognathic surgery.Ellen Wen Ching recommended 1 month before surgeryIf these are not placed before surgery, placement in the immediate postoperative period is often very difficult for the patients because of swelling, discomfort, and limited mouth opening during this time.

Bracket slot size: The most commonly used bracket slot sizes are 0.018″ × 0.025″ (0.46 × 0.64 mm) and 0.022″ × 0.028″ (0.56 × 0.7 mm).0.022″ × 0.028″ bracket slot allows the insertion of heavier archwires making the leveling and aligning easier.

Stabilizing/ initial arch wires in SFOA Leveling and aligning have not yet been performed in SFOA which makes it very difficult to place the wire. Most authors used stabilizing wires before surgery. Some used NiTi wires and some used SS wires.Liou et. al. did not place any orthodontic archwires before surgery. Ching et. al. used 0.016x0.022” superelastic NiTi wire. Carlos et. al. opted to use 0.16”X0.16” NiTi wires at time of surgery. The use of NiTi wires translates into immediate tooth movement after

surgery which can be an advantage. Sugawara and Nagasaka preferred 0.18”x0.25” SS wires and

0.19”x0.26” SS wires in 0.022 slot, adapted to all teeth for preventing any tooth movement. Full slot withstands the forces resulting from intermaxillary fixation. Kobayashi ligature hooks (K-hook) (0.012″ or 0.014″) ligated around the bracket require no use of heavy arch wire, making not only easy to use but often becomes the only option in cases where the inter-bracket span is markedly reduced (e.g. Severe crowding).

Splints in SFOA: The primary purpose of the surgical splints is to emulate the planned surgical movement. Once the osteotomy cuts are made and the jaws are placed in the planned position, the final surgical splint is usually discontinued. Literature indicates the use of final surgical splint as a post-surgical occlusal guide with the intention that it will minimize the occlusal instability during bone healing.(1-4 weeks)If so, it requires frequent selective grinding to accommodate tooth movement. Nagasaka et. al. have used removable Gelb–type splints post operatively. They preferred to use it for about 4 - 6 weeks after surgery Sugawara et. al. modified the surgical splint into a removable maxillary occlusal splint. The surgical splint as a post-surgical occlusal guide may not be necessary because:

1. Rigid fixations can overcome the instability that might follow.
2. Occlusal guide grinding demands precision and considerable chairside time.
3. Minimal mouth opening, during the postoperative recovery time, the patient will be under remarkable stress during the surgical splint maneuvering.

Intermaxillary fixation: IMF serves as a mode of immobilizing the jaw segments Different techniques: direct interdental wiring, IMF screws, arch bars, eyelet wiring, and cap splints. The objectives of minimizing the duration of the IMF and surgical splint are Commence OTM as soon as possible such that RAP can be utilized to the maximum. The rigid internal fixation, if done adequately, is sturdy enough to resist relapse which is thought to occur due to premature occlusal interferences. If the IMF is left for several weeks post-surgery, one must consider additional days of hospitalization along with postoperative recovery issues such as assisted feeding and oral hygiene deterioration.

Lab procedures: Several authors have termed the planned occlusion that is determined during model surgery as the transitional occlusion, treatable malocclusion, surgical temporary occlusion, or intended transitional malocclusion (ITM). The transitional occlusion is an occlusion that is set up immediately after surgery such that the existing malocclusion lies within the orthodontically manageable tooth movement boundary. The ‘transitional occlusion’ could be transfigured into a final occlusion to establish a stable relationship between the occlusion and corrected skeletal structures. There is an ideal anatomic relationship with opposing dentition exhibiting a cusp to fossa relationship which results in structural durability, functional efficiency, and aesthetic harmony. Per surgery and model surgery offers a simple and reliable method of assessing and formulating the treatment plan of a dentofacial deformity using routinely available tools of assessment such as photographs, study models, and radiographs (cephalographs). The diagnostic information obtained from clinical findings and radiographic assessments are integrated in the paper surgery to establish a surgical plan. The paper surgery is emulated on a face-bow transfer, articulator-mounted study models in model surgery for surgical splint creation. The treatment plan, when using 2D data, is essentially a composite of clinical evaluation and cephalometric (both Lat. & PA ceph) assessment using Schwarz’s Gnathic profile field (GPF).Also, rule of thirds is applied for the evaluation and correction of face.

SURGICAL PROCEDURES/TREATMENT PLANNING

Treatment considerations in skeletal class I in SFOA Skeletal Class I patients requiring surgery predominantly exhibit a severe sagittal discrepancy, either in a bimaxillary protrusion or a retrusion relationship. Could be corrected either by en-bloc distalization or mesialization of the MMC by performing LeFort I osteotomy and bilateral sagittal split osteotomy or by anterior segmental osteotomy. In such cases, Control of maxillary occlusal plane is the key for the successful treatment. The factors to be considered when performing these surgeries would be

1. The extent of surgical movement required for the correction of the complexity and

2. The amount of extraction space utilization especially created during anterior segmental osteotomy surgery.

Segmental osteotomy is primarily indicated when the discrepancy is defined by the following conditions:

1. Dental proclination requiring extraction space for the correction of anterior teeth inclination.
2. Moderate to severe crowding requiring extraction space for unraveling of crowding.

Treatment considerations in skeletal class II in SFOA: skeletal class II malocclusion typically involves proclination of mandibular incisors and upright/mild proclination of maxillary incisors. SFOA may be particularly beneficial for a class II patient with a retrusive mandible. Immediately after surgery the Class II malocclusion becomes a super class I or Class III relationship following mandibular advancement, with an edge-to-edge incisor relationship or bimaxillary dentoalveolar protrusion. This situation therefore requires the use of class III orthodontic mechanics or it can also be corrected by extracting all first premolars followed by retraction as in class I bimaxillary protrusion cases. The resulting improvement in the tone of the lower lip and tongue increases the forces acting on the incisors in both arches. In class II division 2 cases, it is difficult to perform SFOA as there is a less overjet. In such cases surgery can be performed after up righting the upper anteriors, obtaining the sufficient overjet for the advancement of mandible or surgery can also be performed directly without presurgical orthodontics thereby getting reverse overjet, which can be corrected post-surgically.

Treatment considerations in skeletal class III in SFOA: In these cases, the lower incisors are usually crowded and retroclined while the maxillary incisors are flared out. When surgery is performed first, a class III malocclusion always becomes a class II relationship immediately after mandibular setback which should be maintained with surgical splint. It requires class II orthodontic mechanics after surgery and adjustment of the anterior teeth can be managed postoperatively.

Postoperative procedure in SFOA:

The objectives of orthodontic treatment after surgery in the SFOA technique are dental alignment, arch coordination, and occlusal settling, that together might take another 6-12 months. Leelasinjaroen et. al. suggested postsurgical orthodontic treatment could begin as early as 1 week - 1 month postoperatively. Kim et. al. suggested to wait 4-6 weeks. The surgical splint and IMF should be removed for the tooth movement. Post-surgery use of chin cup appliance in Class III patients provides a substantial support for the retention of Class III correction, thus ensuring minimal or no skeletal relapse. It is important to apply the chin cup as early as possible, preferably, within a week post-surgery whilst taking care of facial swelling that has occurred after surgery. The chin cup should be continued for the first 3–4 months post- surgery. Appropriate cushioning has to be provided for patient comfort. Wear duration: Apply as soon as possible postoperatively with full-time application in the first month followed by nighttime (10–12 h) wear in the second and third months. Force magnitude: begin with lighter force of approximately 250 g (9 Oz) per side and gradually increase to 450 g (16 Oz).The chin cup can be occipital-pull, intended for patients that had shown mandibular protrusion with horizontal growth pattern, and a vertical-pull, which could be used for vertical growth pattern with excessive anterior facial height

Surgery first protocol with clear aligner treatment

Case selection for Surgery First patients may be assessed by setting up the surgical jump at stage 1 and evaluating for 3 point occlusal contacts in the occlusion. In the Clincheck software, set up the tooth movements to remove existing dental compensations and position the teeth over the basal bone. This can be assessed by evaluating the pre-surgical occlusion when the surgical

CONCLUSION

- Performing orthognathic surgery before orthodontic treatment has multiple advantages including: shortened treatment time, increased patient acceptance, and the utilization of RAP.
- If the cases are selected carefully, the orthodontist and the surgeon are experienced enough to predict the final occlusion beforehand, and the level of cooperation between the clinicians is high, the results are very promising
- By utilizing the principles of surgery first technique, the pre-surgical orthodontics period can be shortened even if it is not eliminated.

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