

SURGERY FIRST ORTHOGNATHIC APPROACH

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ABSTRACT:

Surgery first orthognathic approach eliminates the pre surgical orthodontic phase and makes use of the regional acceleratory phenomenon and the natural forces from the soft tissues and helps in greatly reducing the treatment time. Apart from reduced treatment duration, because dental decompensation is eliminated, profile improvement has led to good patient satisfaction and cooperation. This article reviews the benefits of this procedure, its diagnosis, indications, and treatment planning in detail.

Key words: *surgery first, regional acceleratory phenomenon*

1. INTRODUCTION:

A conventional orthognathic surgery involves three stages-the Pre-orthognathic orthodontic treatment-which is done to relieve the dental compensations. It shows the true skeletal discrepancy preoperatively. It also involves leveling and aligning the teeth, divergence of roots adjacent to surgical sites where interdental osteotomies are planned. This step is followed by the actual orthognathic surgical procedure and finally the post-surgical orthodontic phase where finishing and detailing is done. The main drawback with the presurgical orthodontic step is when dental compensation is carried out, it worsens the patient's profile. Also the duration of this procedure is relatively long, as tooth movement is against the direction of nature.

2. HISTORY:

The term orthognathic surgery was first coined by Hullihen¹ in 1849. The introduction of the mandibular sagittal split ramus osteotomy by Trauner and Obwegeser² in 1957, marked the beginning of the modern era of orthognathic surgery. This intraoral approach could move the mandible in three dimensions according to the designated surgical plan, keeping the condyle in the glenoid fossa. Maxillary Lefort I osteotomy was first reported by Obwegeser³ to move the maxilla in all the three dimensions reporting a large series of maxillary osteotomy cases in 1969, which has become one of the most popular method for correcting skeletal class II or III deformities.

In 1988 Behrman and Behrman⁴ introduced the concept of surgery first and Orthodontics second, which is defined as starting with the surgery with no presurgical orthodontic procedure and the orthodontic treatment is performed postoperatively. Caution is important when embarking on a "Surgery First" course of treatment.

Later SFA was proposed by Nagasaka et al in 2003 at Tohoku university in Sendai Japan for patients with skeletal deformity⁵. This approach has two significant advantages immediate correction of soft-tissue deformities and reduced treatment time.

3. SURGERY FIRST ORTHOGNATHIC APPROACH:

In this approach, the pre surgical orthodontic phase is eliminated. Bherman and Bherman claimed that the normalized surrounding soft tissues—lips, cheeks, and tongue—facilitate postoperative tooth movement and reduce the length of orthodontic treatment. After the correction of the skeletal base discrepancy, the direction of postsurgical treatment coincides with the natural direction of spontaneous dental compensation and muscular force, thereby decreasing the time to full compensation.

4. REGIONAL ACCELERATORY PHENOMENON:

The other reason why this approach is effective is that, it makes use of the regional acceleratory phenomenon which also helps in reducing the treatment duration. The regional acceleratory phenomenon (RAP) was described by Frost^{6,7} in 1989. After an osteotomy, active bone remodeling with rapid metabolic activity within the tissues is present.

The by-products of bone metabolism have been measured in patients' blood samples following orthognathic surgery: Serum alkaline phosphatase and C-terminal telopeptide of type I collagen are two bone markers which were 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 dentoalveolus. This effect can be seen upto 4 months postsurgically.

The fact according to the Hernandez-Alfaro et al^{8,9} that the orthodontic treatment is shortened to an average of 37.8 weeks implies that dental movements are significantly expedited. This improved efficiency of orthodontic forces is significantly related to the process of demineralization and remineralization consistent with the wound-healing pattern of the RAP. Together with the orthognathic procedure, selective bone injury through the performance of buccal corticotomies enhances the activating stimulus for the RAP in the periodontium.

5. DIAGNOSIS:

Conventional paper and model surgery remains the most widespread and standard method by which surgical planning is achieved. However, the limitation of it was using 2-dimensional tools for accurate prediction of 3-dimensional surgical and orthodontic movements.

Later, Computer aided surgical simulation (CASS)¹⁰ helps to plan craniofacial surgery in 3 dimensions. First a surface laser scanning of the dental models is done which helps to create a skull model. On the skull model, virtual surgery to simulate orthognathic skeletal movements is done.

6. TIMING OF BONDING:

Sugawara and Nagasaka⁵ recommended bonding just before surgery. But the problem with this method is that, the bond strength of the bracket to the teeth may be less and it may fail to resist the forces of inter maxillary fixation. Villegas¹¹ recommended the brackets should be placed 1 week before orthognathic surgery. Ellen wen ching¹² suggested placing brackets 1 month before surgery. Federico Hernandez recommended 10-14 days after surgery.

7. STABILIZING/ INITIAL ARCHWIRES IN SFOA:

Liou¹² et al did not place any orthodontic archwires before surgery. Ching¹³ et al used 0.016x0.022" superelastic NiTi wire. Baek¹⁴ et al suggested the archwire can be bonded directly to tooth surfaces to function as an arch bar a few days prior to surgery.

The use of nickel-titanium wires translates into immediate tooth movement after surgery which can be an advantage. However, the orthodontist loses the opportunity to observe the stability of the surgical correction prior to starting the tooth movement.

8. ORTHOGNATHIC SURGERY:

In class 2 division I malocclusion:

SFOA may be particularly beneficial for a class II patient with a retrusive mandible. A class II malocclusion is converted to a super class I or Class III relationship following mandibular advancement, and an edge-to-edge incisor relationship or bimaxillary dentoalveolar protrusion on surgery. 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. Thus the resulting improvement in the tone of the lower lip and tongue increases the forces acting on the incisors in both arches.

In class 2 division II malocclusions:

In this type of cases it is difficult to perform SFOA as there is a reduced overjet. In such cases surgery can be performed after proclination and aligning the upper anteriors and after getting the sufficient overjet for the advancement of mandible for the correction of skeletal deformity .

Or, SFOA procedure can also perform directly without presurgical orthodontics in these cases by getting reverse overjet, and levelling and alignment can be done after surgery.

For a moderate to deep curve of spee and proclined lower incisors in class II mandibular retrognathism, the anterior segment of the mandible could be levelled and intruded surgically through anterior segmental osteotomy so that the mandible could be advanced properly.

Alternatively, the mandible could be surgically advanced to an edge-to-edge incisor relationship and without occlusal contact in the posterior teeth and then postoperatively, the mandibular anterior teeth could be orthodontically intruded so that the mandible rotates upward and forward for posterior occlusal contact and a better chin projection.

In class 3 malocclusions:

In these cases, class 3 malocclusion is converted to a class 2 relationship during surgery. It is maintained with surgical splint immediately after surgery and it requires class II orthodontic mechanics after surgery and adjustment of the anterior teeth can be managed postoperatively.

Proclined maxillary incisors/ retroclined lower incisors in a class III can be managed by extraction of first premolars/ anterior segmental osteotomy and clockwise rotation of the maxilla.

In this approach, occlusion cannot be used as a guide for establishing treatment goals, unlike traditional surgical orthodontic treatment, in which decompensation of the incisors and coordination of the dental arches are performed before surgery.

A moderate to deep mandibular curve of Spee in a class III case is levelled preoperatively / surgically by anterior segmental osteotomy to avoid the upward and forward rotation of the mandible postoperatively. A chin cup could be applied to prevent mandibular skeletal relapse in the first 3 months postoperatively. Baek et al¹⁴ suggested posterior maxilla impaction can decrease occlusal interference and increase the amount of mandibular backward rotation.

9. TRANSVERSE ARCH COORDINATION:

For a wide maxilla with a transverse discrepancy more than a molar width on each side, they could be coordinated surgically by a 3-piece Le fort 1 osteotomy of the maxilla. If the maxillary transverse discrepancy is less than a molar width on each side, they could be coordinated by postoperative orthodontic tooth movement. This can be done by setting up the buccal slope of the palatal cusps of the maxillary molars occluding on the lingual slope of the buccal cusps of the mandibular molars on both sides. In case of a narrow maxilla, surgically assisted rapid palatal expansion could be the treatment of choice.

10. POST-OPERATIVE PROCEDURE IN SFOA:

The objectives of orthodontic treatment after surgery in the SFOA technique are: dental alignment, arch coordination, occlusal settling, these together takes around 6-12 months.

Leelasinjaroen¹⁵ et al suggested postsurgical orthodontic treatment could begin as early as one week to one month postoperatively. Kim¹⁶ et al suggests to wait for 4-6 weeks after surgery. The surgical splint and intermaxillary fixations is removed for tooth movement. 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 Phenomenon (RAP).

MEMO strategy:

The MEMO (Maximum Efficient Minimum Orthodontics) strategy given by Jin Young Choi¹⁷ consisted of minimum preoperative orthodontic treatment, preparation for surgery and postoperative orthodontic treatment. In most cases, for treatment efficiency, the orthodontist suggests minimum pre-operative orthodontics treatment approach for a couple of months before surgery for levelling and alignment, decompensation and arch coordination can be achieved. In addition occlusal prematurity can also be removed by this procedure. MEMO strategy is a time saving procedure because it can avoid the complex surgery and reduce the surgical morbidity and unpredictability.

11. ADVANTAGES OVER CONVENTIONAL APPROACH:

- Immediate change in the facial profile, having surgery first eliminates the unsightly pre-surgical profile and allows the chief complaint of the patient to be addressed at the beginning of treatment, this leads to improved cooperation of the patient during orthodontic treatment. The resolution of skeletal and soft tissue imbalance through surgery allows the orthodontist to move the teeth in a normal skeletal and soft tissue envelope which facilitates the orthodontic movement.

According to a systematic review¹⁸, the oral health related quality of life is similar to that of a conventional approach at the end of the treatment. In conventional approach, there is a decrease in OHRQoL following the presurgical orthodontic phase when complete dental decompensation is done. However, with surgery first orthognathic approach, this decrease in OHRQoL is avoided.

- Overall treatment period is reduced. Post-op orthodontic treatment can be progressed rapidly. Treatment times as short as seven months have been reported¹⁶. The pre-surgical orthodontic phase in conventional three-step orthognathic surgery cases is the most time consuming step. Bypassing this step will result in an overall shortened treatment time to 1 to 1.5 years or less. The main factor which is responsible for rapid tooth movement is the regional acceleratory phenomenon (RAP)¹⁹.

Decompensation can be performed effectively and efficiently. Because a class III malocclusion becomes a class II malocclusion after mandibular setback²¹, the resulting improvement in the tone of the upper lip and tongue increases the force on the incisors of both arches, improving the efficiency of incisor decompensation. This phenomenon may be a factor in reducing the duration of orthodontic treatment time. Treatment steps are simple: The surgery first approach uses osteotomy to solve both skeletal problems and dental compensation so that the orthodontic treatment becomes less complex. As this treatment prefers non-extraction, orthodontists can set up a treatment plan strategically.

The result of treatment is stabilized. This treatment method can be aided by oropharyngeal function and post-op treatment result seems natural.

If a surgical error or skeletal relapse occurs, compensation can be made with SAS mechanics^{20,21}. In conventional treatment, because the decompensation is completed before surgery, it is difficult or impossible to recover from surgical error during postsurgical orthodontic treatment.

12. CONCLUSION:

The surgery-first approach uses osteotomy to solve both skeletal problems and dental compensation so that the complexity of orthodontic treatment becomes less and also shortens the entire treatment time by making use of the RAP. The essence of this approach relies on careful orthodontic and surgical planning.

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