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Surgery First Approach to Orthognathic Surgery

A Project
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University of Baghdad, Department of Orthodontics
in Partial Fulfillment for the Bachelor of Dental Surgery

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Certification of the Supervisor

I certify that this project entitled the "**Surgery First Approach Orthognathic Surgery"** was prepared by **Ruqayah Myasar Mohammed Al-Dabooni** (Fifth year undergraduate student) under my supervision at the Collage of Dentistry/ University of Baghdad in partial fulfillment of the graduation requirement for the degree of Bachelor of Dental Surgery.

Prof. Dr. Akram Faisal Alhuwaizi

B.D.S., M.Sc., Ph.D.

Dedication

To

My first supporters… My Mother & Father

My three Brothers & Grandmother

My best friend Daila

To everyone who loved, support & lighten the way.

Acknowledgements

First and foremost, praises and thanks to **Allah** Almighty for helping me fulfill my dream, for his blessings throughout my work to complete it successfully.

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LIST OF ABBREVIATION

BSSRO	Bilateral sagittal split ramus osteotomy
CAD/CAM	Computer-aided design and computer-aided manufacturing.
CBCT	Cone-beam computed tomography
COS	Conventional orthognathic surgery
IVRO	Internal vertical ramus osteotomy
MMF	Maxillomandibular fixation
RAP	Regional acceleratory phenomenon
SARPE	surgically assisted rapid palatal expansion
SFA	Surgery first approach
SFOA	Surgery first orthodontics after
TADs	Temporary anchorage devices
VAS	Visual analog scale

Introduction

The treatment of malocclusion with skeletal discrepancies requires orthognathic surgery in combination with orthodontic treatment; orthognathic surgery is the treatment of choice for correction of various dentofacial deformities **(Mahmood *et al*., 2018)**.

The term ‘orthognathic’ is derived from the Greek orthos: correct or straight, and gnathos: jaw **(Naini and Gill, 2017)**.

The orthognathic treatment, including the pre and postsurgical orthodontic treatment, and orthodontic treatment requires management to improve the dental occlusion, function, smile, and speech **(Sabri, 2006)**.

Conventional orthognathic surgery (COS) requires a certain duration of presurgical orthodontics to alleviate the dental crowding, level the curve of Spee, decompensate dental inclinations, remove any occlusal interferences, and coordinate the upper and lower arches **(Mahmood *et al*., 2018)**.

However COS has the obvious disadvantage of both before and after orthognathic surgery, newer concept and technique of “Surgery First Orthodontics After” (SFOA) approach or “Surgery-First Approach” (SFA) entails first performing orthognathic with the goal of reducing some of the disadvantages and inconveniences of presurgical orthodontics treatment. In SFOA there is no presurgical phase; surgery is performed first followed by comprehensive orthodontic treatment to achieve the desired occlusion and reduced overall treatment duration **(Mahmood *et al*., 2018; Jeyaraj and Chakranarayan, 2019)**.

Aims of the study

The aims of this study are:

1. To compare “Surgery First Approach” to conventional approach to orthognathic surgery.
2. To identify the advantages, disadvantages, risks, indications and contraindications of “Surgery First Approach” orthognathic surgery.

Chapter One: Review of Literature

1.1 Definition of orthognathic surgery

Orthognathic surgery: it is the combined orthodontic-surgical correction of dentoskeletal deformities **(Ahmadvand and Mehraban, 2021)**.

1.1.1 Objectives of orthognathic surgery

A. Aesthetics

Improved dentofacial appearance, away from deformity and towards normality, is usually the primary motivation of patient's seeking orthognathic surgical treatment **(Obwegeser, 1969)**, and its improvement is primary significance, as the vast majority of patients' desire an improvement in their dentofacial appearance **(Naini and Gill, 2017)**.

B. Function

Functional problems with which patient may present:

1. Difficulty in incising food, mastication, deglutition, and swallowing.
2. Trauma may be a factor in different situations: biting the tongue which tends to occur if the maxillary width is very constricted, traumatic occlusion which will traumatize the anterior palatal mucosa, and attrition.
3. Respiration and sleep apnea, temporomandibular joint dysfunction, speech, and drooling **(Naini and Gill, 2017)**.

C. Stability

It is substantial to strike a pragmatic balance between these three objectives to achieve good alignment of dentition, to harmonize upper and lower dentition in three dimensions, and to improve occlusal interdigitation and dentofacial esthetics **(Jacobs and Sinclair, 1983)**.

1.1.2 History of orthognathic surgery

The first known surgical procedure that may be described as ‘orthognathic’ appears to have been by the American surgeon Simon P. Hullihen in 1849. Edward H. Angle in 1896 was recognized as one of the pioneers of modern orthodontics, who suggested a double resection of the lower maxilla to correct a severe protrusion (Naini and Gill, 2017). The first maxillary osteotomy to correct a malocclusion, which may thereby be referred to as the first maxillary orthognathic procedure, was undertaken by the German surgeon Gunther Cohn-Stock in 1920 **(Cohn-Stock, 1921; Wolfe, 1989)** (Fig. 1).

Figure 1: First maxillary osteotomy to correct malocclusion done by German surgeon Gunther Cohn-Stock in 1920 (Cohn-Stock, 1921).

1.1.3 Steps of conventional orthognathic surgery

The conventional orthognathic surgery involves three steps: Pre-operative orthodontic treatment, followed by orthognathic surgery and post-operative orthodontic treatment (Ahmadvand and Mehraban, 2021).

1.1.4 Pre-operative orthodontic treatment

Presurgical orthodontic preparation was uncommon until 1960. The desire of patients’ and clinicians’ for optimal esthetic and occlusal outcomes resulted

in the most common current treatment approach presurgical orthodontic decompensation of the occlusal relationships and obtaining the normal dental alignment to place the teeth in the correct position during the surgical treatment so the primary aim of preoperative orthodontics is decompensation and occlusal stability after surgery **(Sharma *et al*., 2015)**.

The amount of preparatory orthodontic treatment required for the orthognathic patient is quite variable and it depends on the complexity of tooth movements required and the type of surgery **(Choi *et al*., 2019)**.

1.1.4.1 Objectives of pre-operative orthodontic treatment

According to previous literature **(Sarver and Jacobson, 2007; Nagasaka *et al*., 2009; Leelasinjaroen *et al*., 2012; Jeong *et al*., 2017; Choi *et al*., 2019)** the objectives of conventional pre-operative orthodontic treatment are:

1. Dental decompensation so that the teeth can be placed on the basal irrespective of the relationship with the opposing jaw.
2. Prepare the patient for surgery.
3. Ensure the best possible position of dentition in the individual jaws before surgery.
4. Aligning and leveling of the teeth and resolving any crowding.
5. Coordinating the upper and lower jaws.
6. Stabilization of the occlusion after surgery and settling the teeth into better interdigitation area.
7. Adjacent of divergence of roots at surgical sites where interdental osteotomies are planned (Fig. 2).

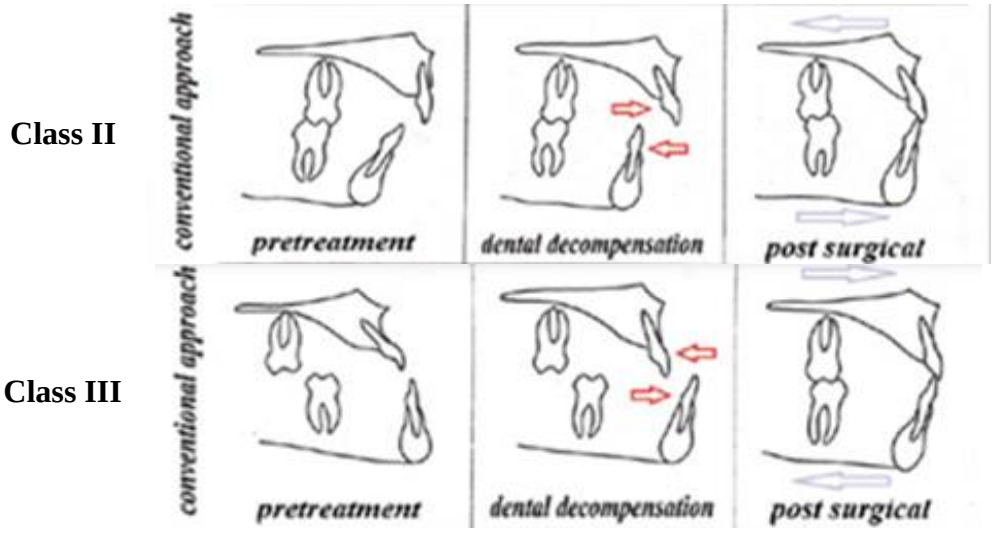

Figure 2: Conventional orthognathic surgery for class II and class III treatment (Ahmadvan, 2021).

1.1.4.2 Advantages of Pre-operative orthodontic treatment

Presurgical orthodontic treatment reveals the true skeletal discrepancy before surgery and helps determine the required amount of dental decompensation that limits the full correction of the skeletal deformity.

The objectives of pre-operative orthodontic treatment are to:

1. Prepare the patient for surgery **(Leelasinjaroen *et al*., 2012)**.
2. Level and align the teeth and Coordinate the arches.
3. Removal of all dental compensations to maximize optimal surgical repositioning of the jaw and to fit the maxilla and mandible into a solid occlusion after surgery (Jacobs and Sinclair, 1983; Sabri, 2006), without appropriate dental decompensation preoperatively, the surgeon is limited by the tooth position in fully correcting the skeletal deformity **(Grubb and Evans , 2007)**.
4. It will establish good teeth inclination, and eliminate tooth-size discrepancies to permit class I canine and molar relationships **(Jacobs and Sinclair, 1983; Reyneke and Sullivan, 2021)**.

1.1.4.3 Disadvantages of pre-operative orthodontic treatment

1. Long treatment time of 7–20 months, increase dental caries, gingival recession, and root resorption **(Luther *et al*., 2003; Grubb and Evans , 2007; O'Brien *et al*., 2009; Diaz *et al*., 2010)**, and there is a progressive deterioration of facial esthetics and dental function preoperatively **(Proffit, 2006; hupp *et al*., 2019)**.
2. Discomfort during mastication and articulation; and psychological problems due to the delays in achieving the patient's main demand, which is usually an esthetic facial appearance **(Jacobs and Sinclair, 1983; Jeong *et al*., 2017)**.
3. If the patient refuses surgery after all these preparations, the results will be catastrophic **(Sharma *et al*., 2015)**.

1.2 Surgery first approach

1.2.1 What is surgery first?

SFA is defined by **Sarver and Jacobson (2007)**, and **Nagasaka *et al.* (2009)** that it provides the best possible normal jaw relations before the initiation of orthodontic treatment. SFA is surgery without preoperative orthodontic preparation; orthodontic treatment is carried out after surgery. In this technique, no prior tooth movements or minimal tooth decompensation for 1 or 2 months in cases with occlusal interferences are implemented before surgery, so it is possible to rapidly achieve facial esthetic appearance, which is the patient's chief complaint before the treatment **(Leelasinjaroen *et al*., 2012)**. It uses osteotomy to solve both skeletal problems and dental compensation, and a transitional occlusion is set up postoperatively. Orthodontics in the surgery first approach is a postoperatively adjunctive treatment to transfigure the transitional occlusion into the solid final occlusion **(Liou *et al*., 2011)**, it is defined by Choi as a team approach between surgeons and orthodontists for orthognathic surgery without preoperative orthodontic treatment **(Choi and Bradley, 2017; Choi *et al*., 2019)**.

1.2.2 History of Surgery first

In 1959, for the first time, Skaggs suggested surgery before orthodontic treatment in patients with mild dental problems. Later, in 1988, Behrman and Behrman proposed a concept like that, which was repeated by **Brachvogel *et al*. (1991)**. However, these were conceptual suggestions only. For the first time, **Nagasaka *et al*. (2009)** applied the surgery first approach clinically in the form of a systematic team approach between the orthodontist and surgeon and published relevant articles and this technique was called the surgery-first approach.

1.2.3 Advantages of the surgery-first

According to previous literature **(Liou *et al*., 2011; Hernández-Alfaro and Guijarro-Martı'nez, 2014; Jeyaraj and Chakranarayan, 2019; Choi and Lee, 2021)** the advantages of SFA are:

1. The patient's chief complaint, dental function, facial esthetics and sleeping disorders are achieved and improved in the beginning of the treatment.
2. Minimal disturbance of patient's social life.
3. The entire treatment period is shortened to 1-1.5 years or fewer depending on the complexity of orthodontic treatment.
4. Direction of the postsurgical orthodontics is the same as the natural compensation and no need for aggravated gross appearance during presurgical orthodontic period.
5. There is more freedom to choose the surgical movement in accordance with the clinical requirement for individual patients.

The reduced treatment time in surgery first approach can be attributed to two main factors: 1) the resolution of skeletal and soft tissue imbalance prior to initiation of tooth movement which allows the orthodontist to move the teeth in a normal skeletal and soft tissue envelope which facilitates the orthodontic movement, the imbalance between the two jaws results in

dentoalveolar compensation which throughout an individual's lifetime, and 2) The regional acceleratory phenomenon (RAP): it is a tissue reaction to a noxious stimulus that increases the healing capacities of the affected tissues **(Kim et al., 2012)**.

1.2.4 Disadvantage of surgery first approach

According to previous reports **(Nagasaka *et al*., 2009; Wang *et al*., 2010; Hernandez-Alfaro *et al*., 2011; Choi *et al*., 2019; Choi and Lee, 2021; Reddy and Potturi, 2021)** the disadvantages of SFA are:

1. Patient selection is critical because the baseline occlusion cannot guide treatment goals. Consequently, high clinical expertise, accurate prediction of postoperative tooth movement, and precise assessment of skeletal discrepancy are mandatory.
2. The bending, bonding, and removal of the surgical wire are troublesome and time-consuming product.
3. Postsurgical instability during bone healing could cause skeletal instability and its influence on relapse.
4. Orthodontic appointments should be scheduled more often than in a conventional approach. This could be stressful for the orthodontist, and it needs constant communication between the surgeon and the orthodontist.
5. Incomplete lip and facial profile immediately after surgery with chewing difficulties due to incomplete occlusion.

1.2.5 Indications of surgery first

1. The first indication for the surgery-first approach should be patient demand and patients, in general, do not like preoperative orthodontic treatment **(Sarver and Jacobson, 2007; Pelo *et al*., 2017)**.

2. Minimal crowding in the anterior teeth, favorable curve of Spee, and normal range of angle between the basal bone to upper and lower incisors **(Choi *et al*., 2019; Reddy and Potturi, 2021)**.
3. Patients who do not require extensive preoperative orthodontics **(Yu et al., 2015)** (Fig. 3 and 4).
4. Normal to mildly proclined/retroclined incisors and minimal transverse discrepancies **(Reddy and Potturi, 2021)**.

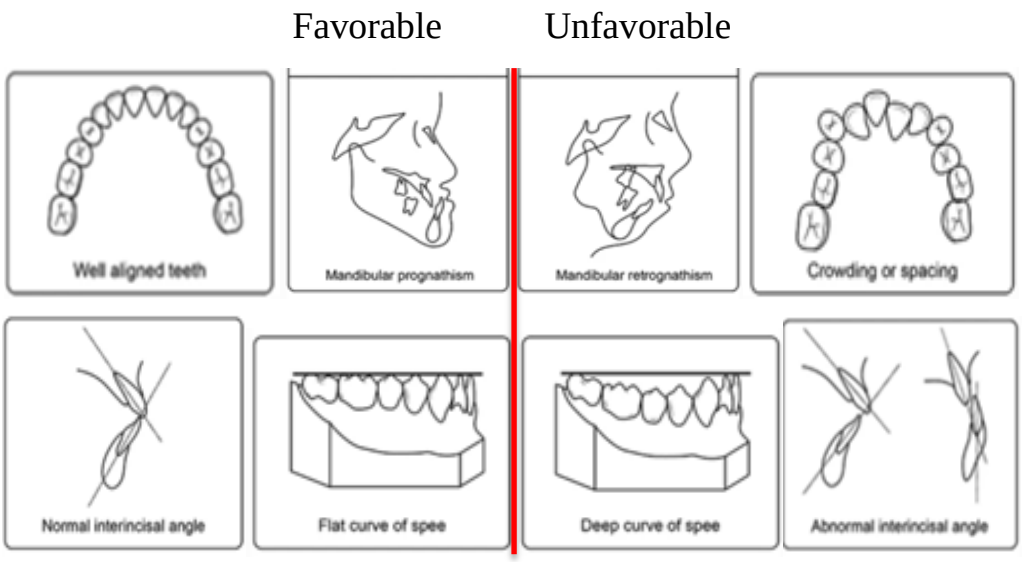

Figure 3: Favorable and unfavorable cases for surgery first approach (Ahmadvand *et al*., 2021).

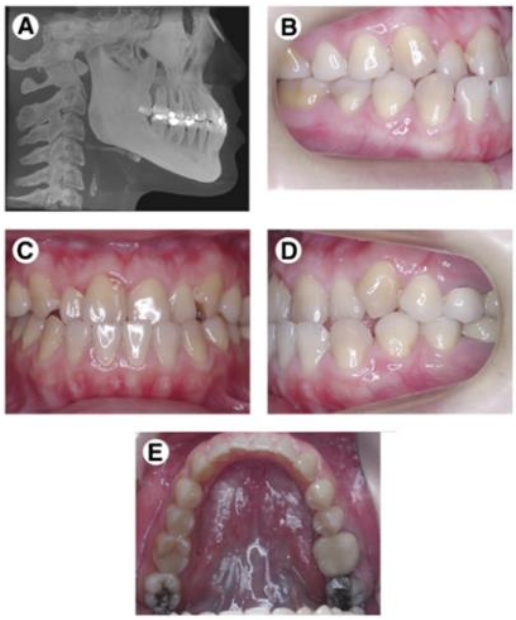

Figure 4: (A-E) The surgery first best indicated case (Liou et al., 2011).

1.2.6 Contraindications of surgery first approach

According to previous reports **(Naini and Gill, 2017; Choi and Lee, 2021; Reyneke and Sullivan, 2021)** the contraindications of SFA are:

1. Severe crowding of the upper anterior teeth that need extraction, a blocked upper lateral incisor on the palatal side may significantly interfere with surgical occlusion.
2. Severe asymmetry with three-dimensional dental compensations.
3. Excessively extruded upper second molars in patient with severe mandibular prognathism causes excessive overeruption of the maxillary second molar so the mandible can't occlude which will affect postoperative stability.
4. Active temporomandibular joint disease and periodontal disease.
5. Disharmony between the upper and lower intercanine widths often in patients with mandibular prognathism results in functional displacement of the tongue.
6. Unilateral crossbite with contralateral normal occlusion horizontal facial asymmetry.
7. Class II deep bite malocclusions, and transverse maxillary deficiency requiring surgically assisted rapid palatal expansion (SARPE).

1.2.7 Limitations of surgery first approach

1. The surgery-first approach cannot use the patient's occlusion as a surgical guide **(Sugawara *et al*., 2010)**.
2. Without the help of 3D virtual imaging and simulation surgery, complicated cases cannot be treated by the surgery-first approach **(Hwang *et al*., 2017)**.
3. As postoperative occlusion is generally unstable in the surgery-first approach, a surgical wafer should be maintained for guiding postoperative mandibular movement **(Hwang *et al*., 2017)**.
4. If there is a need for the application of surgical wire before surgery, any tooth movement should not occur preoperatively **(Baek *et al*., 2010)**.

5. In the case of mild temporomandibular disorder, the surgery-first approach with intraoral vertical ramus osteotomy may be difficult **(Hernández-Alfaro and Guijarro-Martínez, 2014)**. The drawback of the surgery-first approach with intraoral vertical ramus osteotomy is 4 weeks of intermaxillary fixation **(Park *et al*., 2013)**.
6. As the peak activity of RAP is 1 to 2 months postoperatively **(Yaffe *et al*., 1994)**.
7. The period of 4 weeks of intermaxillary fixation will delay the initiation of postoperative orthodontic treatment. The correction of mandibular retrognathism with deep bite, extraction case, and the narrow palatal arch is not possible without preoperative orthodontic treatment **(Liou *et al*., 2011)**.

1.2.8 Complications after orthognathic surgery

1. Possibility of infection, cellulitis, abscess, and osteomyelitis.
2. Nonunion or malunion of bones after osteotomy.
3. Orthodontic device problems.
4. Skeletal deformity relapse **(Loureiro *et al*., 2022)**.
5. Fracture of bone: Some complications of orthognathic surgery are associated with a non-ideal separation of bone structures, resulting in unfavorable fractures. In Le Fort I osteotomy, an unfavorable split of the pterygomaxillary junction can lead to a fracture of the pterygoid plates (Chin *et al*., 2017), and the fractured segments may interfere with the mobilization of the maxilla during its advancement or setback and may lacerate the internal jugular vein, the carotid artery, and damage cranial nerves **(Dadwa *et al*., 2015)**. In BSSRO, an unfavorable fracture may happen in the lateral cortex of the proximal segment and the medial cortex of the distal segment of the mandible, the fractured segments should be incorporated into the fixation scheme when possible **(Steenen and Becking, 2016)**.

1.2.9 General guidelines of surgery first approach clinical procedure

1. Brackets are bonded to the upper and lower dentitions three days prior to surgery, but no arch wires are placed. This is to keep the upper and lower dentitions undisturbed and solid before surgery. Orthodontic arch wires are placed 1 week postoperatively for the alignment, whereas the osteotomized jaw bones are held steadily by the rigid fixation. Tooth extraction might be indicated in cases of severe crowding to avoid dental arch overexpansion.
2. For the model surgery, set up the maxilla and mandible in a proper molar relationship and with a positive overbite. The molar relationship could be set up in Class I in cases of non-extraction or bimaxillary first premolar extraction, Class III in cases of lower first premolar extraction, and Class II in cases of maxillary first premolar extraction. Once the molar relationship has been established, the overjet should also have been determined.
3. The postsurgical orthodontic treatment could begin as early as 1 week to 1 month postoperatively by taking advantage of the phenomenon of postoperatively accelerated orthodontic tooth movement. The surgical splint and intermaxillary fixations should be removed for tooth movement **(Eric *et al*., 2011; Reddy and Potturi, 2021)**.

1.3 Surgery-first approach clinical procedure

In general, there are no any major differences between the procedures involved in traditional orthognathic surgery and surgery-first approach.

The biggest difference is that the preoperative orthodontic treatment is simulated outside the mouth, rather than being performed on the patient like in conventional approach. Based on the modeling, surgical occlusion is established and reflected in the orthognathic surgery plan **(Choi and Lee, 2021)** (Fig. 5).

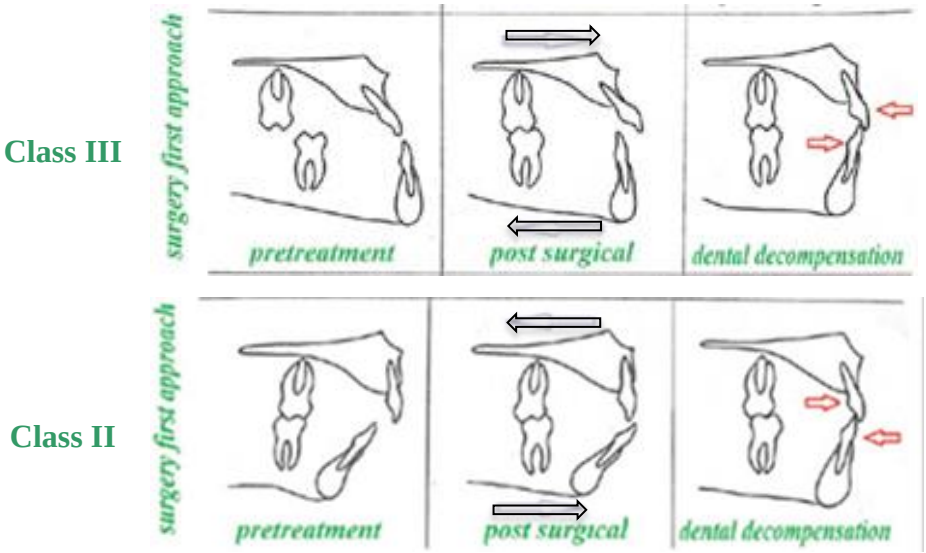

Figure 5: Surgery first orthognathic surgery for class II and class III treatment (Ahmadvan, 2021).

1.3.1 Preoperative management of surgery first approach

A. Patient evaluation

Clinical examination evaluation of the patient starts with an extensive history and review of the patient's medical problems and past surgeries.

B. Systematic patient evaluation

Medical history, dental evaluation, periodontal considerations, occlusal – oral function evaluation, esthetic facial evaluation, facial symmetry, transverse dimensions, facial form, vertical relationship (Fig. 6), profile analysis, lips, labiomental fold, nasolabial angle, chin, soft tissue, skeletal analysis (Fig.7), mandibular incisor evaluation, and TMJ evaluation **(Reyneke and Sullivan, 2021)**. Various technologies are used in diagnosis such as CBCT and intraoral scans and combining these to form a 3D virtual model which being utilized to facilitate the diagnostic procedure**. Choi *et al.* (2009)** and **Swennen *et al*. (2009)** have reported that the use of 3D techniques would result in an accurate diagnostic work up, leading to an efficient surgical protocol and improved outcome.

Figure 6: Individual with vertical maxillary deficiency. Note the change in the shape of the lips and lower facial height with the teeth in occlusion (a) and with the mandible rotated open until the lips just apart (b) (Reyneke and Sullivan, 2021).

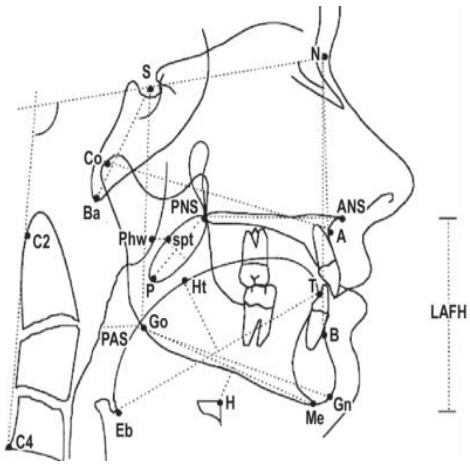

Figure 7: Cephalometric landmarks (Reyneke and Sullivan, 2021).

C. Model surgery setup in the surgery-first approach

Model surgery is one of the most important steps in the preoperative workup for orthognathic surgery **(Choi and Song, 2009)**. Preoperatively, the model is mounted in the standard manner to assess the patient's occlusion (Fig. 8). In the model set-up, teeth that have already adapted to the skeletal discrepancy are simulated and reorganized into their predicted locations. In this process, each tooth in the model is analyzed, simulated, and separated, as would be done in real presurgical orthodontic treatment. Based on the simulated model surgery, intermediate and final wafers for orthognathic surgery without presurgical orthodontic treatment are prepared **(Choi and Lee, 2021)**.

Figure 8: Model surgery setup (Ehmer *et al*., 2012).

D. Virtual 3D model setup

For the last two decades, various attempts have been tried to apply 3-dimensional CAD/CAM technology to orthognathic surgery (Fig. 9). The scope of application is increasing, such as making surgical wafers based on CT data, simulating surgery, or printing surgical guides for bone fixation required in the operating room **(Uribe *et al*., 2013; Kang *et al*., 2015)**. This 3D digital application can be usefully applied to the surgery-first approach, especially in the model setup process **(Im *et al*., 2014; Kim *et al*., 2017; Badiali *et al*., 2019)** (Fig.10).

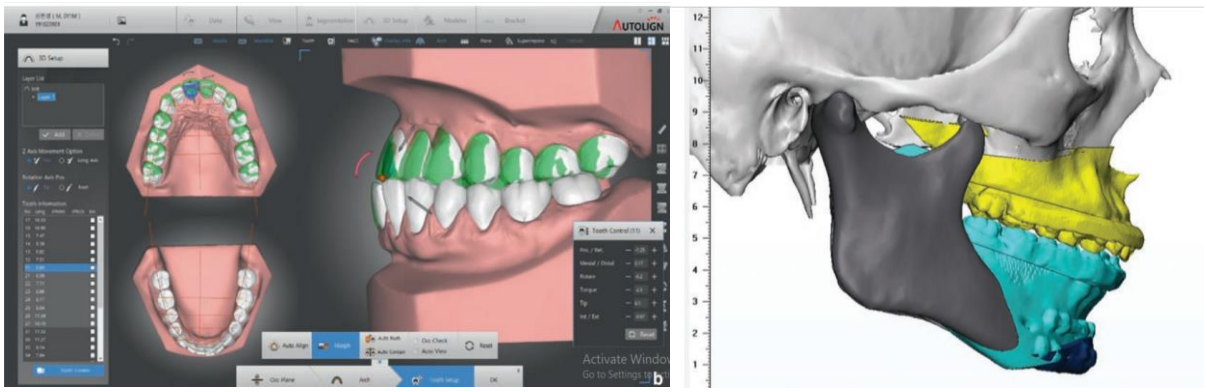

Figure 9: Virtual set-up process and virtual surgery process with different programs for SFA (Naini and Gill, 2017).

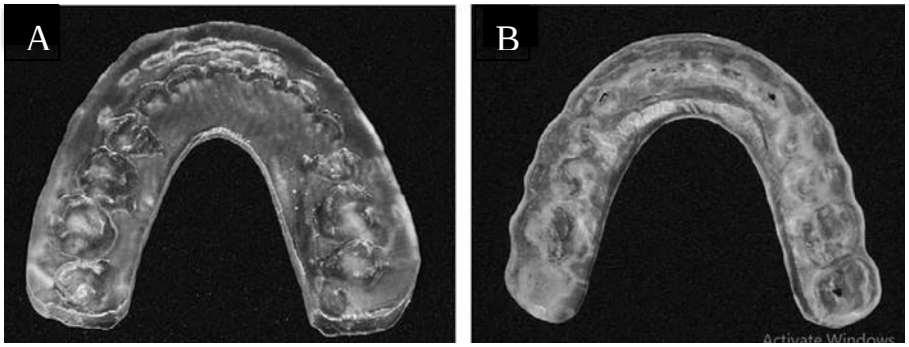

Figure 10: (A) Printing of the intermediate surgical wafer, (B) Printing of the final surgical wafer (Choi *et al.*, 2009).

E. Bonding and stabilization wire

In SFA it is recommended to bond brackets (3 days -1 week) prior to the surgery, stainless steel wires are bent passively and inserted followed by soldering of surgical hooks to facilitate intermaxillary fixation during the surgery **(Kim et al.,2012; Mahmood *et al.*, 2018)**.

1.3.2 Surgery: Main surgical procedures

A. Le Fort I osteotomy

The Le Fort I maxillary osteotomy follows the mid-facial fracture pattern originally described by Rene Le Fort in 1901 from cadaveric studies of simulated facial trauma **(Chirurgio, 1901)**. The Le Fort I osteotomy is performed by making a horizontal cut above the apices of the maxillary teeth from the nasal rim, which is extended posteriorly to the zygomatic buttress, traversing the maxillary sinus walls on each side and the nasal septum (Fig. 11). Care should be taken to avoid damage to the nasolacrimal ducts and the tooth roots **(Taub *et al.*, 2014)**.

B. Bilateral sagittal split ramus osteotomy (BSSRO)

The BSSRO technique, as described by Obwegeser and Trauner in 1957, consisted of a horizontal osteotomy through the medial cortex of the superior portion of the mandibular ramus, an osteotomy through the lateral cortex from

the distal region of the second molar to the midpoint of the mandibular angle, and a vertical osteotomy through the mandibular ramus to connect the medial and lateral bone cuts **(Taub *et al*., 2014)** (Fig. 11 and 12).

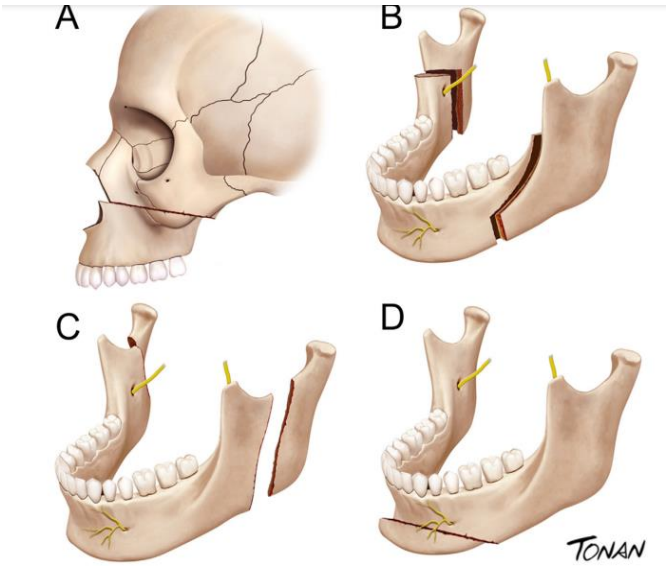

Figure 11: Orthognathic surgery Le Fort I osteotomy (A), bilateral sagittal split ramus osteotomy (B), vertical ramus osteotomy (C), and genioplasty (D) (Loureiroa *et al*., 2022).

C. Internal vertical ramus osteotomy (IVRO)

It is a treatment option for mandibular prognathism **(Ginat *et al*., 2017)**, and it consists of a vertical osteotomy through the ramus from the sigmoid notch to the mandibular angle posterior to the mandibular foramen, followed by a mandibular setback. The proximal segment should be positioned laterally to prevent unfavorable torquing of the temporomandibular joint and to promote bony union **(McKenna and King, 2016)** (Table 1, Fig. 11 and 12).

Table 1: The main difference between (BSSRO) and (IVRO) (Kashani and Rasmusson, 2016; McKenna and King, 2016).

Surgical protocol	BSSRO	IVRO
Osteotomy	Posteroanterior sagittal split	Lateromedial cut
Bone fixation	Rigid internal fixation	No fixation
Postoperative Maxillomandibular fixation (MMF)	None or shorter period with (plate, screws)	Required (for 7–10 days)
Possible injury	inferior alveolar nerve injury	No inferior alveolar nerve injury
physical therapy	No need for physical therapy	need for physical therapy

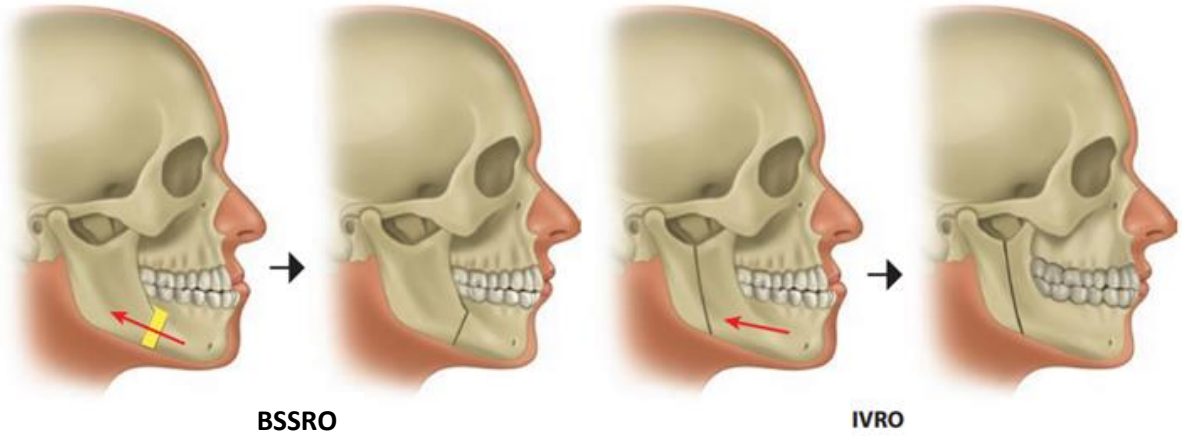

Figure 12: Two major methods for mandibular setback surgery; sagittal split ramus osteotomy and intraoral vertical ramus osteotomy (Choi and Lee, 2021).

D. Genioplasty

Genioplasty involves changing the position and/or shape of the mental protuberance of the mandible to correct chin deformity **(Patel and Novia, 2007)** (Fig. 11).

1.3.3 Postoperative orthodontic treatment

Orthodontic objectives following surgery are generally similar to those considered in finishing a conventional orthodontic case **(Jacobs and Sinclair,**

1983). Whether the wafer is removed early or not, active orthodontic treatment is usually delayed for 2 weeks, until the patient feels up to having treatment. During this time the patient will usually be wearing light intermaxillary guiding elastics, which help to guide the patient into the planned dental occlusion. These should be worn full-time, and the patient should be seen by the surgeon and orthodontist weekly for the first 2 weeks, for close observation of any changes to the dental occlusion. Some patients will have an obvious, well-interdigitated dental occlusal result postoperatively. However, others may need closer observation, with variations in the intermaxillary elastic vectors made as required during this time **(Naini and Gill, 2017; Mahmood *et al*., 2018)**.

1.3.3.1 Postoperative orthodontics goals

According to previous literature **(Jacobs and Sinclair 1983; Mahmood *et al*., 2018)**.The goals of postoperative orthodontic treatment are:

1. Bring teeth to well detailed position and proper intercuspation within a reasonable time (4 to 6 months), taking advantage of the unlocked occlusion following surgery.
2. Final tooth alignment, maximum interdigitation, finalizing torque, and artistic positioning are all completed at this time.
3. One should strive for an ideal overjet/overbite relationship compatible with a mutually protected occlusion where centric occlusion equals centric relation.
4. The establishment of correct root parallelism is important, particularly in segmental cases where the roots of the teeth adjacent to the osteotomy sites should have been kept divergent to provide additional interdental space for the surgical cuts.
5. In cases that involve increasing lower anterior face height (deep bites), most of the orthodontic tooth movement should be accomplished postsurgically, This may take several months, and there needs to be little concern about untoward orthodontic effects causing relapse or a compromise of the surgical

correction. Such cases should be retained by using a removable maxillary retainer with a small anterior bite plane if some relapse is expected. A fixed mandibular canine-to-canine retainer provides adequate support to prevent retroclination of the lower incisors.

1.3.3.2 Postoperative orthodontic procedure

At the first appointment, the splint removed and the teeth should be allowed to settle rapidly to full contact and it is best done with light undersized round wire 0.016- inch stainless steel wire with light box elastics worn full-time for the first 4 weeks, arch wire change every 2-3 week **(Sabri, 2006)**. During the first postoperative month, miniscrews (application of TADs) were used for skeletal anchorage **(**Fig. 13), thereby avoiding premature loading of the orthodontic appliances and undesirable dental extrusions. At 1-year follow-up, patient satisfaction with treatment outcome was assessed with a visual analog scale (VAS) ranging from 0 (not satisfied at all) to 10 (greatest possible satisfaction) **(Hernandez-Alfaro *et al*., 2011)**.

Figure 13: Surgical protocol: Use of temporary anchorage devices. Two additional screws were placed between central incisors in order to facilitate postoperative overbite control.

Chapter Two: Discussion

The SFA consists of orthognathic surgery followed by postsurgical orthodontic treatment without any presurgical orthodontic treatment, and it is regarded as a paradigm shift confronting the traditional orthognathic approach. In the past, orthognathic surgery was often performed without the proper presurgical orthodontic treatment before the establishment of the traditional modern protocol consisting of presurgical orthodontic treatment for roughly 12–18 months, orthognathic surgery, and then postsurgical orthodontic treatment for approximately 6–12 months.

The modern concept of SFA is much more sophisticated. It should be based on a presurgical simulation and consideration of the following factors: whether occlusal instability can be overcome with postsurgical orthodontic treatment, including the active use of mini-screws; where the dentition should be moved postoperatively; and how far the dentition should be moved, these factors must be anticipated and planned in advance **(Choi and lee, 2021)**.

Chapter Three: Conclusions and Suggestion

1. In the researches opinion, the surgery-first approach is for patients who have skeletal problems with acceptable dental alignment, and in these cases that will lead to less time for treatment and less patient life disturbance, and it is efficient and time saving technique **(Mahmood *et al*., 2018)**.
2. However, it needs a patient with good teeth alignment, highly professional surgeons and orthodontists with excellent collaboration, Postoperative orthodontic treatment is mandatory, there is susceptibility to relapse, and passive wire bending is cumbersome and time consuming.

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