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SURGERY- FIRST ORTHOGNATHIC APPROACH

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A B S T R A C T

The disadvantages of having orthodontic interventions both before and after orthognathic surgery include a long treatment time and temporary worsening of facial appearance. Nowadays, the concept of surgery-first, followed by orthodontic treatment is applied to orthognathic surgery cases in different orthodontic centres in the world. This concept and technique is called "surgery-first-orthognathic-approach" or "surgery-first approach" (SFA).

Rigid fixation (skeletal anchorage system) of the bony segments and regional acceleratory phenomenon were keys to broad implementation of the SFA.

This article is intended to provide an overview of SFA including Indications, Evolution, Contraindications, Favourable and Unfavourable cases**,** Different Protocol, Advantages and Disadvantages of Surgery First Approach

Keywords: *Orthodontic interventions; Orthognathic surgery; Surgery-First Approach (SFA); Surgery-First Orthognathic Approach; Treatment duration*

INTRODUCTION

The surgery-first approach (SFA) or the surgery-first orthognathic approach (SFOA) can be defined as an approach wherein orthognathic surgery is directly performed without presurgical orthodontic treatment. [(1)]Since orthognathic surgery aims to correct a dentofacial deformity caused by a skeletal discrepancy, one might wonder why the skeletal issue isn't always addressed first, given that it is the primary underlying cause of the deformity. This approach seems both rational and logical at first glance [(2)]

SFOA could potentially be performed without presurgical orthodontic treatment by utilizing an innovative dental mock operation. Orthodontic interventions before and after orthognathic surgery can have drawbacks, including extended treatment durations of 7 to 47 months and temporary worsening of facial appearance. Recently, the "surgery-first" approach, where surgery is performed prior to orthodontic treatment, has gained popularity in orthodontic centres worldwide. This technique, known as the "surgery-first-orthognathic-approach" (SFA), relies on rigid fixation (skeletal anchorage systems) of the bony segments and the regional acceleratory phenomenon, which have been key to its broader adoption.
This article aims to provide an overview of the SFA. [3]

Moreover, advancements in instruments, fixation techniques, equipments, and surgical methods for orthognathic surgery have reduced overall treatment time and enhanced postoperative stability. Additionally, the use of virtual systems has streamlined model surgeries and splint fabrication [4].

DEFINITION AND EVOLUTION OF THE SFA
The SFA is an orthognathic approach that consists of orthognathic surgery followed by postsurgical orthodontic treatment without any presurgical orthodontic treatment. [5]

In 1849, Hullihen was the first to report the orthognathic correction of mandibular elongation [6]. Since then, various surgical techniques have been developed to address mandibular prognathism through dissection of the mandibular body or ascending ramus. In 1957, Trauner and Obwegeser introduced sagittal splitting ramus osteotomy, which is considered the starting point of the modern era of orthognathic surgery [7]. Following the introduction of mandibular osteotomy, Obwegeser became the first to develop the LeFort I osteotomy, a technique designed to reposition the maxilla in all three dimensions. In 1969, he reported a comprehensive series of cases involving maxillary osteotomy [8].

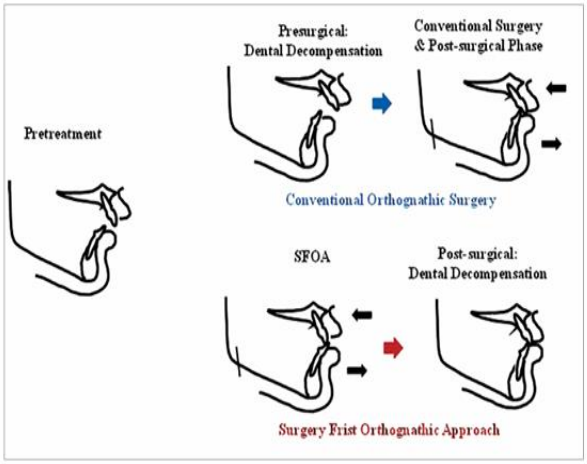

Figure 1 - Various approaches for the treatment of skeletal deformity.

INDICATIONS
The suggested criteria for the Surgery-First Approach [9] (SFA) are as follows:

- Well-aligned teeth or mild crowding
- Flat to mild curve of Spee
- Normal to mild Proclination or retroclination of incisors
- Minimal transverse discrepancy

Additionally, this approach is indicated in cases where decompensation is required.

CONTRAINDICATIONS TO SFA [10]

- Deep curve of spee [11].
- Abnormal interincisal angle.
- Severe transverse discrepancy.
- Arch in coordination.
- Severe crowding.

FAVOURABLE AND UNFAVOURABLE CASES FOR SFOA

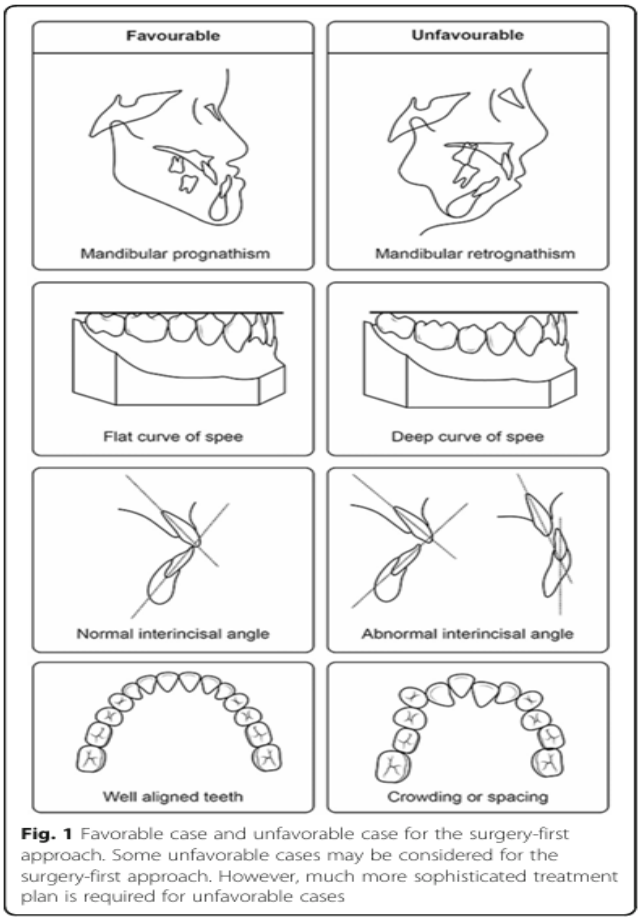

Fig. 1 Favorable case and unfavorable case for the surgery-first approach. Some unfavorable cases may be considered for the surgery-first approach. However, much more sophisticated treatment plan is required for unfavorable cases

SFOA PROTOCOL [10]

SFOA demands effective treatment planning, proficient model surgery, and careful post-surgical orthodontics. It can be approached using two methods. The 'surgical-driven' approach which addresses both jaw and dental deformities through the surgical procedure [11]. The 'orthodontic-driven' approach corrects the jaw deformity by surgery and the dental deformity via orthodontics [12]. This procedure employs miniplates as part of a skeletal anchorage system (SAS) for orthodontic movement after the correction of the jaw deformity.

The Sendai technique for SFOA can be summarized into preoperative, surgical, and post-surgical stages as follows [13]:

A) Preoperative:

- **Diagnosis:** The treatment goals for each patient are determined using dental casts, radiographs, and photographs as diagnostic tools.
- **Bonding and Stabilization Wire:** The Sendai SFOA recommends bonding 0.022-inch brackets one week before surgery. Passive 0.018 x 0.025-inch stainless steel wires are bent and inserted, followed by the soldering of surgical hooks to enable intermaxillary fixation during the procedure.
- **Model Surgery:** Traditional facebow records are taken, and models are adjusted based on the treatment goals derived from prediction tracings. A surgical splint is then created to maintain the interim transit malocclusion (ITM) after surgery. The Sendai SFOA advises against achieving three-point occlusal contact during mandibular surgery, as this may lead to posterior lengthening of the ramus, which has a high likelihood of relapse.
- **Surgical Splint:** The surgical splint, which may be placed in the mandibular arch, particularly in cases involving maxillary surgery, consists of four ball hooks and a lingual arch [13]

B) Surgical:
The Sendai SFOA recommends a modified bilateral sagittal split osteotomy, combined with T-shaped miniplate fixation, for mandibular surgery [14]. This design helps prevent condylar dislocation caused by a buccal step near the mandibular second molar area, thereby reducing the likelihood of relapse. The titanium miniplates are positioned at strategic locations to support dental movements.

C) Post-surgical Orthodontics:
A removable Gelb-type splint is worn for approximately four to six weeks following the surgery. After the splint is removed, various dental movements in the sagittal, vertical, and transverse planes are achieved using the SAS [14].

ADVANTAGES OF THE SFOA [11]-

- Postsurgical orthodontic direction closely mirrors natural compensation
- Potential for reduced overall treatment duration
- No significant worsening of facial appearance during the presurgical orthodontic phase
- Minimal disruption to the patient's social life
- Patient- centred approach with early improvement in facial aesthetics
- Efficient coordination of the surgical and orthodontic schedule, allowing sufficient postoperative time to address skeletal and facial changes
- Early correction of sleep disorders
- Elimination of the need for tooth movement during presurgical orthodontic treatment

DISADVANTAGES OF THE SURGERY- FIRST APPROACH (SFA) [11]:
Some researchers have pointed out several drawbacks of the SFA, including reduced predictability of mandibular counterclockwise rotation and challenges in applying the approach to cases with severe transverse deficiency. The potential disadvantages of the SFA are summarized as follows:

- Time-consuming simulation of tooth set-up for surgical occlusion
- More complex and delicate surgical procedures
- Necessity for precise, experienced decision-making regarding the feasibility of SFA
- Complicated wire bending required for the surgical arch wire
- Inability to extract third molars prior to surgery
- Possible need for an extended period of intermaxillary bony fixation
- Incompetent lip and facial profile immediately following surgery
- Chewing difficulties due to incomplete occlusion right after surgery

DISCUSSION
The surgery-first approach in orthognathic surgery has recently created a broader interest in completely eliminating time-consuming preoperative orthodontic treatment.

The SFA involves orthognathic surgery followed by postsurgical orthodontic treatment, without any presurgical orthodontic preparation. It represents a significant shift from the traditional orthognathic approach. Historically, orthognathic surgery was often performed without proper presurgical orthodontics, before the establishment of the modern protocol, which includes about 12–18 months of presurgical orthodontics, the surgery itself, and 6–12 months of postsurgical orthodontic treatment. However, this early approach is not comparable to the contemporary SFA concept [15].

The modern SFA concept is more advanced and relies on presurgical simulation, taking into account factors such as whether occlusal instability can be addressed with postsurgical orthodontic treatment (including the use of mini-screws), where the dentition should be moved postoperatively, and how much movement is needed. These elements must be carefully anticipated and planned. Regardless of how occlusal instability is assessed after orthognathic surgery without presurgical orthodontics, we believe the modern SFA concept should be defined as a process that involves simulating the postsurgical occlusal condition in advance. In conclusion, most published studies related to the surgery-first approach were mainly on orthognathic correction of skeletal Class III malocclusion. Both the surgery-first approach and orthodontics-first approach had similar long-term outcomes in dentofacial relationship. However, the surgery-first approach had shorter treatment time [3].

CONCLUSIONS
The Surgery-First Approach has evolved significantly since its introduction, with technical advancements expanding its indications. However, the limitations of this approach must still be carefully considered. A collaborative team approach

between surgeons and orthodontists is essential for ensuring successful treatment outcomes. Recently, the development and advances in cone-beam computed tomography (CBCT), 3D cameras, laser scanning and various computer-aided surgical simulations (CASS) have made the creation of diagnostic and treatment plans for orthognathic surgery much easier and more accurate than in the past.

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