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Case Report

Modified surgery-first approach for management of severe class III malocclusion with maxillary skeletal midline discrepancy

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ABSTRACT

This case report describes orthosurgical case that used the recently introduced surgery-first approach to correct a severe skeletal class III malocclusion with severe maxillary midline discrepancy. A 23-year-old adult male presented with severe mandibular prognathism and midline discrepancy associated with upper jaw. Firstly partial orthodontic movement were facilitated to decrowd the lower teeth in order to avoid any hindrance while anterior tooth advancement. After which prediction of the postsurgical tooth movement and surgical simulation was done by using Nemoceph software than 2-jaw surgery that included maxillary advancement differentially initiated to correct midline followed by mandibular setback was performed using a surgery-first approach. Immediate facial improvement was achieved and postsurgical orthodontic treatment was efficiently carried out. The total treatment time was 11 months. The patient's facial appearance improved significantly and a stable surgical orthodontic outcome was obtained even after patient was followed for six years.

Keywords: Surgery first approach, Bilateral saggital split osteotomy, Orthopantomagram**,** Regional accleratory phenomenon

INTRODUCTION

The conventional approach to orthognathic surgery involved preoperative orthodontics, followed by surgery and postoperative orthodontics was the sole recognized approach to orthognathic surgery. The first orthognathic surgeons noticed that the amount of mandibular setback surgery was bounded by the magnitude of overjet between the maxillary and mandibular incisors.[1] Presurgical orthodontic phase has multiple pitfalls even though it has advantage of providing stable occlusal after surgery. It results in decompensation of anteriors, which causes further worsening in facial appearance and function especially in patients with class III malocclusion which further increase the patient's perception of facial disharmony and has great negative impact psychologically. Researchers have proposed that presurgical orthodontics is the most time-consuming phase of conventional orthognathic approach, and it often tend to prolong treatment duration, with little or no significant benefit in large number of patients. Therefore, the "orthodontics-first" approach became a widely acknowledged precept.[2] It emphasized that surgical repositioning of the jaw was possible only after the removal of all dental compensations prior to surgical phase. Over the years, acceptable levels of stability and satisfaction with posttreatment surgical outcomes have validated this approach gives good results.[3]

In 1959, Skaggs raised the issue of surgical timing in relation to orthodontic treatment and suggested that surgery should pave the way for orthodontic treatment if

a satisfactory interact relationship can be reached surgically. This is the first documented reference to what is currently known as "surgery first" (SFOA). It was hypothesized that when the jaw relation is corrected, the surrounding soft tissues-lips, cheeks, and tongue-facilitate postoperative tooth movement and reduce the length of orthodontic treatment.[4]

In contrast to conventional orthodontic-orthognathic surgery, the presurgical occlusal relationship in a surgery-first approach often does not reflect the true underlying skeletal discrepancy. In such cases, obtaining near acceptable inclination of the maxillary and mandibular incisors with respect to their underlying basal bones before surgery becomes particularly important if the maxillomandibular jaw complex is to be positioned exquisite without compromising the surgical results.[5]

A contraindication for the surgery-first approach is found when the planned postsurgical occlusion results in an interference between the anterior teeth, precluding a stable occlusion. In these patients, presurgical orthodontic phase is mandatory to eliminate these occlusal interferences.

However, the aim of this presurgical period is only to eliminate this interference without extending treatment to achieve full leveled and aligned arches. Therefore, modified surgery-first approach can be considered, where the arches are set up to achieve a transitional class I malocclusion (Class II molar relationship if the maxillary premolars are extracted) after surgery. Hence, the presurgical phase is dramatically reduced, usually limited to 6 months.[5]

This case report demonstrates how the total treatment time can be reduced by combining a limited orthodontic phase first for the followed by modified surgery-first approach by doing BSSO with collaboration with maxillary advancement in a planned way to correct skeletal discrepancy. This short presurgical orthodontic period also eliminates the anterior interferences to obtain a stable occlusion after surgery.

CASE REPORT

A 23-year-old boy came to the orthodontic centre complaining that his lower jaw is forwardly placed and he is unable to chew properly. His medical history was noncontributory, and the temporomandibular joint examination was normal, with maxillary midline shifted to right side. The pretreatment facial examination showed a concave soft tissue profile.

The nasolabial angle was acute, and both upper and lower lips were retrusive with respect to the E-line. The mandibular dental midlines were coincident with the facial midline and maxillary midline shifted to right side by 5 mm. The intraoral examination showed that the patient had a full complement of teeth (Figure 1).

Figure 1: Pretreatment photographs.

The molar relationships were class III on the left and right side. The maxillary arch was constricted transversely, resulting in a crossbite from second molar. The mandibular dental arch had crowding of 6mm. He had a negative overbite of 0mm and a negative overjet of -5 mm (Figure 1).

The cephalometric analysis showed a moderate skeletal class III relationship (ANB angle, -8), and retroclined maxillary incisors {U1- NA angle, 30^0 (6 mm)} and mandibular incisors {L1- NB angle, 19^0 (5 mm)} (Figure 2 and Table 1).

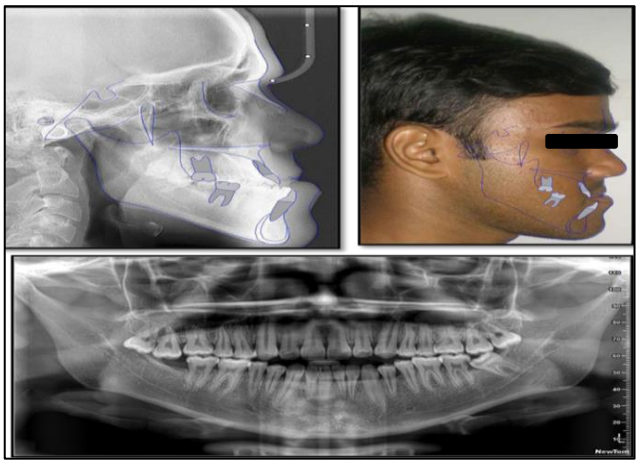

Figure 2: Lateral cephalogram and OPG.

Table 1: Cephalometric values.

Parameters	Pre-rx	Pre-sur
SNA	84^0	84^0
SNB	92^0	93^0
ANB	-8^0	-9^0
U1-NA	30^0 (6)	31^0 (6)
L1-NB	19^0 (5)	26^0 (6)
GoGn-SN	28^0	28^0
FMA	22^0	23^0
IMPA	98^0	102^0
LAFH	69 mm	69 mm
Co-A	84 mm	84 mm
Co-Gn	117 mm	117 mm
ANS-PNS: GoPog	1:1.1.8	1:1.1.8

The patient was diagnosed with a skeletal and dental Class III malocclusion with retrusive maxilla, prognathic mandible, and maxillary midline shifted to right side by 5mm, mild mandibular crowding, and a bilateral posterior crossbite from molar bilaterally.

Treatment objectives

The treatment objectives for this patient were to align the maxillary and mandibular dental arches, improve the maxillary and mandibular incisor inclinations, correct the bilateral posterior crossbite, obtain ideal overjet and overbite, achieve a good functional occlusion, and improve the skeletal and soft tissue profile.

Treatment alternatives

Based on the treatment objectives, the following alternatives were explained to the patient.

Conventional surgery approach: Alignment of upper and lower arch followed by orthognathic surgery and postsurgical orthodontic treatment. The advantage of this approach was that teeth could be moved into ideal positions with respect to their respective bones before surgery, making this approach more predictable. The disadvantage was that it could have taken about two years.[6-8]

Modified surgery-first approach: The literature has reported that the time required for presurgical orthodontics varies from 6 months to several years, but the average time is between 12 and 18 months.

In collaboration with oral surgeons, conventional 3-phase surgical orthodontics has been exclusively practiced as the gold standard in providing predictable and stable results. However, the surgery-first approach concept was recently introduced, and several successful case reports have demonstrated that it can be a viable alternative approach in surgical orthodontics.[9-11] By incorporating decompensational movement of the dentition into the surgical planning, the presurgical orthodontic stage is eliminated. During the postsurgical phase, all dental movements, which include alignment, incisor decompensation, and surgical relapse, are corrected. It is also well recognized that tooth movement after surgery is more effective. Therefore, the overall treatment time for a surgery-first approach is considerably reduced.[12]

For this case, modified surgery first approach is chosen after a short initial alignment period of 2 months. This period was necessary because of the crowding in the mandibular arch, to eliminate any dental interference after jaw manipulation during surgery. Uniqueness of this case report was correction of upper maxillary midline by surgical manipulation which was shifted to right side by 5mm.

Treatment progress

After the initial appointment for records, initial alignment was initiated for relieving of mandibular crowding. After 2 months when crowding relieved, overall negative overjet was -6 mm and overbite of 0 mm. The maxillary midline was still deviated to the right side by 5 mm. After relieving lower crowding, maxillary and mandibular 16×22 stainless steel arch wires with surgical hooks were placed and the patient was referred for orthognathic surgery (Figure 3).

Figure 3: Presurgical photographs.

Presurgical STO was taken to assess whether Bijaw surgery improves the overall treatment outcome or not

and also to educate the patient prior to surgery to gain maximum cooperation. LeFort I maxillary osteotomy was performed with a 5 mm asymmetric advancement of the maxilla along with correction of midline and mandibular setback of 7 mm initiated to correct skeletal class III relationship and the negative overjet (Figure 4).

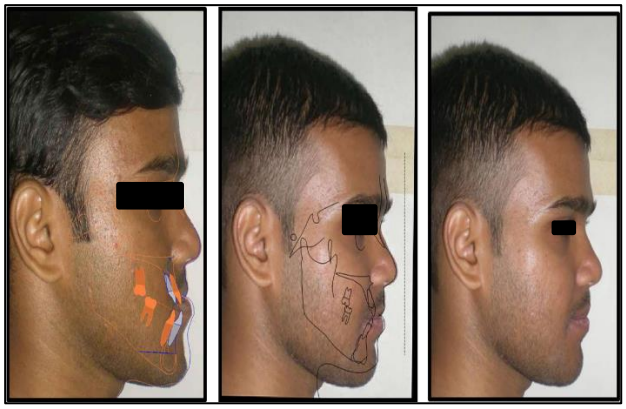

Figure 4: Pre surgical STO.

At post-surgical follow up, there was slight crossbite due to transverse discrepancy. So, progressive arch expansion started followed by settling initiated for finishing.

Treatment results

At the end of finishing and settling, the maxillary and mandibular dental arches were well aligned, the buccal crossbite was corrected, and a well-interdigitated occlusion with class I molar and class I canine relationships and ideal overjet and overbite were achieved. The maxillary and mandibular midlines were coincident with respect to the facial midline, and a consonant smile arc was also achieved (Figure 5).

Figure 5: Post treatment photographs.

The posttreatment cephalometric analysis showed significant improvements in the skeletal relationship. Six year follow up superimposition X ray showed acceptable stability with no relapse (Figure 6).

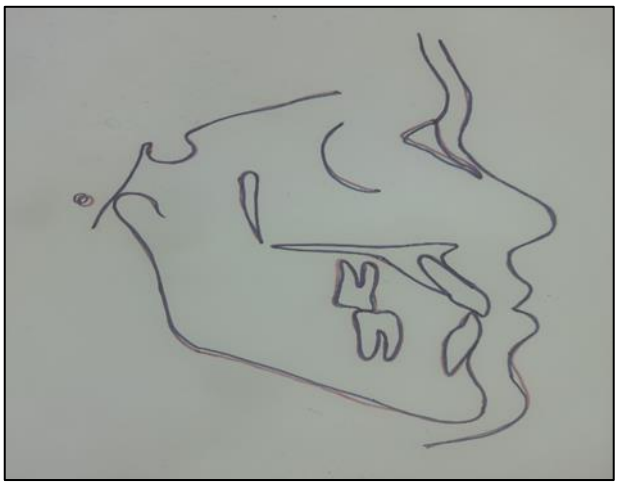

Figure 6: Cephalometric superimposition (Black line-pre-treatment, red line-post treatment).

Cephalometric evaluation at pretreatment, post-surgical and 6 years after surgery showed remarkable improvement with no relapse Table 2.

Table 2: Cephalometric values

Parameters	Pre-Rx	Pre-sur	Post-surg	Post-surg after 6 year
SNA	84^0	84^0	92^0	92^0
SNB	92^0	93^0	91^0	91^0
ANB	-8^0	-9^0	1^0	1^0
U1-NA	30^0 (6)	31^0 (6)	27^0 (6)	27^0 (6)
L1-NB	19^0 (5)	26^0 (6)	25^0 (6)	25^0 (6)
GoGn-SN	28^0	28^0	22^0	22^0
FMA	22^0	23^0	22^0	22^0
IMPA	98^0	102^0	102^0	102^0
LAFH	69 mm	69 mm	70 mm	70 mm
Co-A	84 mm	84 mm	90 mm	90 mm
Co-Gn	117 mm	117 mm	111 mm	111 mm
ANS-PNS: GoPog	1:1.1.8	1:1.1.8	1:1.1.6	1:1.1.6

DISCUSSION

Presurgical orthodontics in conventional orthognathic approach is mainly to achieve stable occlusion which allows acceptable skeletal correction and establishing good intercuspation post-surgery. Time consumption and it has negative effect on patient appearance and psychology is most common disadvantage of conventional orthognathic surgery.[13,14]

Whereas SFOA provides several advantages over conventional approach i. e., immediate improvement of facial appearance, reduced total treatment time by eliminating the presurgical orthodontic stage and facilitating tooth movement after surgery contributed due to Rapid acceleratory phenomenon (RAP).[15,16]

Liou et al used the term "transitional occlusion" to describe the occlusion that will be used to fabricate the surgical splint. The transitional occlusion must be stable enough to; allow a splint fabrication and a predictable skeletal correction. Postoperatively, orthodontic treatment must transfigure this transitional occlusion into a more stable final occlusion. In our patient, because of the crowding in the mandible, it was impossible to establish a stable transitional occlusion, making it necessary to perform the initial alignment. The inclinations of the maxillary and mandibular incisors with respect to basal bone are an important parameter that determines the optimal skeletal correction. In this patient, the mandibular incisors needed to be moved labially to a certain extent to correct this inclination and prevent occlusal interference. Alignment of teeth enables the achievement of this objective.[17]

After the orthognathic surgery performed, there is increased mobility of the teeth noticed which has been attributed mainly due to the RAP (Rapid acceleratory phenomenon). RAP can be induced in the jaw bones by periodontal surgery, corticotomy, and osteotomy. RAP is a physiologic process leading to decreases in localized bone density and accelerated bone turnover, causing faster tooth displacements. Different mechanisms have been postulated for the osteopenic effect seen in RAP, such as osteoclast and osteoblast cell population shift in number, neovascularization, local and systemic mediators and calcium depletion. Yaffe et al after-flap surgery in rats, observed evidence of the RAP at 10 days of healing and almost complete recovery within 120 days. These authors characterized the initial phase of RAP as an increase in cortical bone porosity because of increased osteoclastic activity and speculated that RAP might be a contributing factor to increased mobility of the teeth after periodontal surgery. Similarly, surgically assisted tooth movement with a corticotomy has been associated with an early tartrate-resistant alkaline phosphatase staining (osteoclastic activity).[17] It is suggested that RAP in humans begins within few days of surgery, typically peaks in the first and second months, and may take from 6 months to more than 24 months to subside. Although this phase of expedited tooth movement is not exclusive to either approach, the surgery-first approach uses this golden window for the most time-consuming step: decompensation of the dental arches, which, unlike in the conventional approach, occurs after the surgery. Because tooth movement occurs at a rapid rate, we proposed that postsurgical appointments must be scheduled more often as compared to conventional treatment approach. In our patient, we recalled the patient every 2 weeks.[18-22]

Relapse appears to be of great concern in patients treated with SFOA. Ko et al in their study compared SFOA with conventional orthognathic approach. They found both approaches to be equivocal in terms of stability of results. Despite numerous pros and cons, SFOA is gaining popularity with time. SFA is highly technique sensitive and should be performed only by highly experienced orthognathic teams. Detailed treatment planning and constant communication between the surgeon and the orthodontist are absolutely indispensable.[23] The present case was followed for six years followed which cephalometric evaluation was done showed excellent stability with good clinical results (Table 2 and Figure 5).

CONCLUSION

To achieve excellent results by SFOA, meticulous treatment planning by ortho-surgical team is mandatory along with correct patient selection. SFOA is beneficial in terms of reduced treatment time and improvement of esthetics in present patient during postoperative period helped in settling occlusion and preventing relapse. In case with skeletal midline deficiency, we can correct the discrepancy during surgical phase with proper pretreatment evaluation and planning which further reduces overall treatment time. Because tooth movement occurs at a rapid rate after SFOA, it is proposed that postsurgical appointments must be scheduled more frequently as compared to conventional treatment approach.

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