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# Various treatment modalities of skeletal malocclusion and their related complications

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## Abstract

Case series of 15 patients in which orthognathic surgery in our institution was performed. The purpose of this study was to report our experience with par aesthesia and nerve involved, relapse, tooth which was extracted or not during orthognathic surgery.

Fifteen patients with skeletal malocclusions were enrolled in this study (Anterior open bite, Complex Open Bite, facial asymmetry, Hypo plastic maxilla, Mandibular Prog nathism, Man dibular retrognathia, Prognathic mandible, Retrognathic mandible and skeletal class 2 malocclusion). Patients then underwent orthognathic surgery, which included Anterior Maxillary Osteotomy, Anterior maxillary setback, B/L saggital split osteotomy, Lefort 1 osteotomy and B/L saggital split osteotomy and mor phometric correction. With the advantages of earlier improvements in patient facial aesthetics and dental function increasing patient acceptance and complications which was discussed above are reported.

**Keywords:** Ortho gnathic, Par aesthesia, Relapse, Hypo plastic, Prognathic, Retro gnathic

## Introduction

Since ancient times, humans have been conscious of aesthetic beauty. A fundamental principle of aesthetics was articulated by Thomas Aquinas in the 13th century: "The senses pleasure in things correctly pro portioned." St. Thomas was describing the connection between aesthetics and numbers in mathematics.[6]

Leonardo da Vinci painted a face in the 16th century and divided it into smaller rectangles, which was thought to be a replica of a geometric shape. Ideal occlusion, according to Edward Angle (1907), is essential for esthetics[1]. Wuerpel asserts that a face is attractive and displays harmonious traits if the ratios of each of its parts are appropriate, i.e. He refers to this as balance, where no one structure is overemphasized in respect to the others. Until the development of Cephalometrics, soft tissues were analysed using a variety of hard tissue techniques without consideration for their anatomical adaptation to the corrected dentoskeletal relationship. In an effort to maximize face alterations, facial analysis was done to pinpoint both positive and unfavorable characteristics. The basic therapeutic goals for orthognathic surgery are –

An esthetically pleasing face is regarded as one in which various facial features are well proportioned and balanced, and relate well to other facial features.[2] Recently, orthognathic surgery followed by postsurgical orthodontics without presurgical orthodontic treatment, known as the surgery-first approach, has become favored. Proposed by Nagasaka et al., it is a new concept in the combined orthodontic–orthognathic treatment for jaw deformities. In order for patients to receive state-of-the-art care when correcting their deformities, the orthognathic team must be able to -

1) Correctly diagnose existing deformities.
2) Establish an appropriate treatment plan.
3) Execute the recommended treatment.

| **Basic therapeutic goals** | **Examples** |
|---|---|
| • Function- | Normal mastication, speech, ocular function, respiratory function. |
| • Aesthetics- | Establishment of facial harmony and balance. |
| • Stability- | Prevention of short-and long-term relapse. |
| • Minimizing of treatment time- | Provision of efficient and effective treatment. |

Diagnostic factors and risk factors are the conditions that may modify the treatment planning and affect the outcome of the surgical procedures. Awareness of potential risk factors is mandatory for proper treatment planning and for proper preoperative patient counseling. This is a case series of 15 patients in which orthognathic surgery in our institution was performed**.** The purpose of this study was to report our experience with par aesthesia and nerve involved, relapse, tooth which was extracted or not during different modalities of orthognathic surgery. Fifteen patients with skeletal malocclusions were enrolled in this study (Anterior open bite, Complex Open Bite, facial asymmetry, Hypo plastic maxilla, Mandibular Prog nathism, Mandibular retrognathia, Prognathic mandible, Retro gnathic mandible and skeletal class 2 malocclusion).

Patients then underwent different orthognathic surgery, which included Anterior Maxillary Osteotomy, Anterior maxillary setback, B/L saggital split osteotomy, Lefort 1 osteotomy and B/L saggital split osteotomy and morphometric correction.

**Patients and methods**

This study examined a consecutive series of patients who were treated with orthognathic surgery. The aim of this study was to report our experience with procedure performed, par aesthesia and nerve involved, relapse, tooth which was extracted or not during orthognathic surgery.

Following patient consultation and the surgeon's examination, it was determined whether the patient was a good candidate for orthognathic surgery. A treatment plan was then developed using clinical information, dental models, and cephalometric analysis. No patient had presurgical ortho dontic alignment. A splint was created after a model operation.

The patient was subsequently put under general anaesthesia for orthognathic surgery. Different Surgical modalities included Anterior Maxillary Osteotomy, Anterior maxillary setback, B/L saggital split osteotomy, Lefort 1 osteotomy, lefort 1 osteotomy and B/L saggital split osteotomy and mor phometric correction were performed.

**Model surgery**

Special attention must be paid during the model surgery to achieve the desired transitional occlusion (ITM), which must be provided for the slight postsurgical movement of the teeth.

In this study, none of the participants required postoperative orthodontic care. The molar relationship can be utilized as a starting point to guide a temporary occlusion. A suitable buccal overjet must be established on the bilateral molars at the same time.

Tooth extraction can be employed during the procedure to create room for a segmental osteotomy and the coordination of both arches.

Further- more, the midline of the dental arches must be coinciding or close to the facial midline with a rather complex scenario. It is thus recommended that only experienced teams perform these surgeries.

**Maxillary and mandibular procedures.**

**Bimaxillary surgery**

Extra-oral

Comparison of frontal and lateral views of the facial profile: pretreatment (A, B, C), immediately after surgery (D, E, F), and post treatment (1 month) (G, H, I).

**Intra- oral**

Comparison of frontal and lateral views of the intra-oral tooth profile: pretreatment (a, b, c), immediately after surgery (d, e, f), and post treatment (1 month) (g, h, i).

**Lefort-1 Osteotomy**

Procedure shown below and mentioned with J, K, L, M.

**Bilateral sagittal split osteotomy (BSSO)**

Procedure shown below and mentioned with N, O, P, Q, R.

**Statistical analysis**

The data were entered on a Microsoft Excel spreadsheet and imported into Statistical Package for Social Sciences (SPSS) version 22 for statistical analysis. Data was present in frequency, percentage and graphical form.

**Case profile**

**PRE-OP**

A B C

**Immediate post-op**

D E F

**Follow up**

G H I

**Intra-oral**

**Pre-op**

A B C

**Immediate post op**

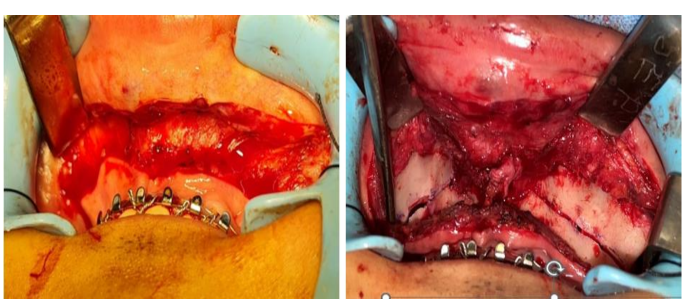
D E F

**Follow up**

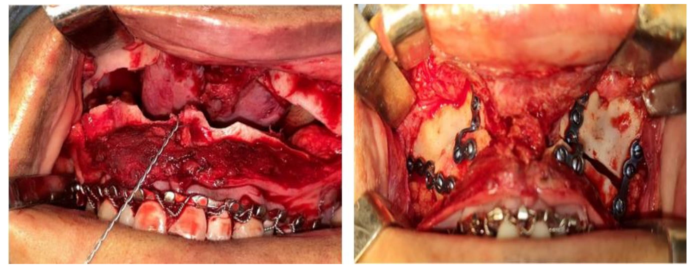
G H I

**Maxillary procedures**

**INTRA-OP (lefort-1 osteotomy)**



J K



L M

Mandibular procedures

Bilateral sagittal split osteotomy (BSSO)

N O

P Q

R

**Result**

In our study the mean age of the patients are 21.7 ± 4.8 years (table -1). In which 8 were male and 7 were female. In which facial profile was also noted and evaluated 10 were Concave, 1 was Convex and 4 was Straight (table-1). Type of malocclusion also evaluated and found that 2 patients were in Class 1 malocclusion, 4 in Class 2 malocclusion, 3 in Class 3 malocclusion,1 in Class 3 with severe anterior open bite, 1 in Cross bite in posterior region, 1 had Facial asymmetry, 3 in Skeletal Class 2 Mal occlusion (table-1). After radiological investigation and cephalometric analysis, different diagnosis was made i. e Anterior open bite (1 patient), Complex Open Bite (1 patient), facial asymmetry (2 patient), Hypoplastic maxilla (1 patient), Mandibular Prognathism (3 patients), Mandibular retrognathia (4 patients), skeletal class 2 malocclusion (3 patients**).**

Different treatment modalities or surgery was performed i. e Anterior maxillary Osteotomy (1 patient), Anterior maxillary setback (2 patient), B/L sagittal split osteotomy (7 patient), Lefort 1 osteotomy (3 patient), Lefort 1 osteotomy and B/L sagittal split Osteotomy (1 patient), Mor phometric correction (1 patient) (table-2).

Post operative complication (after 1 week) was evaluated, firstly for paresthesia. Infraorbital par aesthesia was observed in 4 patients, bilateral mental nerve paresthesia in 3 patients, unilateral mental nerve paresthesia in 1 patient, paresthesia present only over the lower lip in 1 patient and paresthesia present only over the right premolar region in 1 patient. (Table-4)

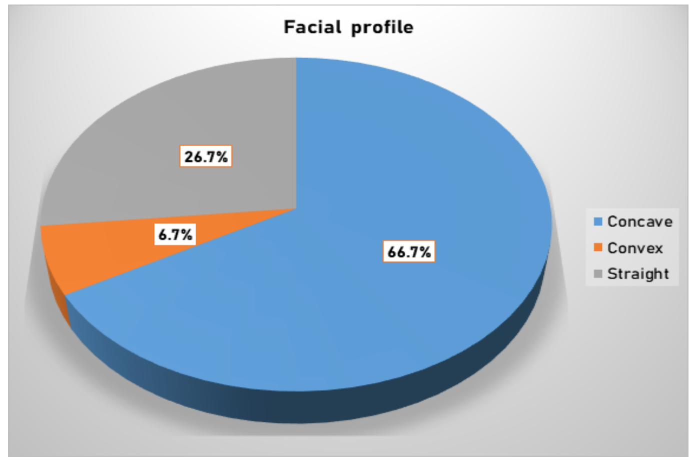
Paresthesia resolved in all the patient except 4 in which resolved after 2 month. (Table-4)

Relapse was not recorded in any of the patient even after 1 year follow-up.

Table 1:

| Variables | | |
|---|---|---|
| Age in years (Mean ± SD) | 21.7 ± 4.8 | |
| Gender | Number | Percentage (%) |
| Male | 8 | 53.3 |
| Female | 7 | 46.7 |
| Facial profile | | |
| Concave | 10 | 66.7 |
| Convex | 1 | 6.7 |
| Straight | 4 | 26.7 |
| Type of Malocclusion | | |
| Class 1 malocclusion | 2 | 13.3 |
| Class 2 malocclusion | 7 | 46.7 |
| Class 3 malocclusion | 4 | 26.3 |
| Cross bite in posterior region | 1 | 6.7 |
| Facial asymmetry | 1 | 6.7 |

Graph 1:




Graph 2:

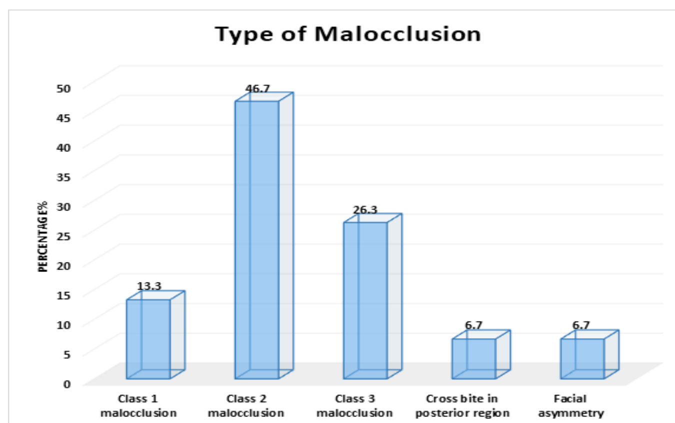



Table 2:

| Type of surgery performed | Number | % |
|---|---|---|
| Maxillary procedures | | |
| Anterior maxillary Osteotomy | 1 | 6.7 |
| Anterior maxillary setback | 2 | 13.3 |
| Lefort 1 osteotomy | 3 | 20.0 |
| Mandibular procedures | | |
| B/L sagittal split osteotomy | 7 | 46.7 |
| Morphometric correction | 1 | 6.7 |
| Bimaxillary procedure | | |

| | | |
|---|---|---|
| Lefort 1 osteotomy and B/L sagittal split Osteotomy | 1 | 6.7 |
| Intra-op extraction of 3rd molar | | |
| Absent | 9 | 60.0 |
| Extracted | 1 | 6.7 |
| Present but not got extracted | 5 | 33.4 |

Table 3:

| Post op complication (after 1 week) Involved nerve | Number | % |
|---|---|---|
| None | 5 | 33.3 |
| Infraorbital nerve | 4 | 26.7 |
| Inferior alveolar nerve | 6 | 40.2 |

Table 4: par aesthesia

| | Par aesthesia | |
|---|---|---|
| Time interval | YES | NO |
| 1 month | 4 | 11 |
| 3month | 0 | 15 |
| 6 month | 0 | 15 |
| 9 month | 0 | 15 |
| 12 month | 0 | 15 |

**Discussion**

Over the past fifty years, surgical techniques and determining factors in skeletal malocclusion procedures have unwaveringly improved following extensive research on the stability of surgical outcomes. Advances in surgical methods and realised affecting elements must be regularly assessed to enable further advancement. Given their mean age range of 21.7 ± 4.8 years, this study's patient cohort can be readily compared to other those in studies by Kierl et al. [11] and Dowling et al. [12] whose patients' mean ages were 26.6 and 27.3 years, respectively. We introduced a coordinate system into the cephalograms to get more linear readings. Although they were based on various reference lines, these systems are described in the literature. [13] [14]. The x-axis was frequently selected to be the Frankfort plane or NLS line, and the y-axis was perpendicular to the NSL line drawn via the S or N point. The most accurate coordinate systems are those based on the sella and nasion points since they are objectively repeatable on cephalograms, unaffected by surgery, and unaffected by any values as long as the head is correctly positioned during the radiographic examination.

One problem that is likely to hinder any cephalometric assessment of reference points for the Frankfort horizontal plane is radiopacities (ear rods of the cephalostat, acoustic meatus), which could make it difficult to generate an objectively reproducible reference line. While a coordinate system offers linear distance values as its major advantage, the use of different reference lines makes it difficult to compare data in the literature. [15] The present study confirms this pattern, and we found that in all the above-mentioned procedures relapse was not found in any of the patients even after follow up of 1 year. It is important to keep in mind, however, that mandibular-advancement results are among the most stable of surgical outcomes according to Profit et al. [16] In addition, many of the values involved, especially in minor cases of repositioning, have been so low that they remained below the clinically relevant level of 2 mm. [17] It is therefore appropriate to exercise caution in interpreting these results. Since the advent of screw osteosynthesis in 1974, numerous studies have shown it to be more stable than other fixation techniques, hence all of the patients in this study underwent it. [18]-[20] It is hotly debated in the literature whether stability is improved or harmed by repositioning surgery in one or both jaws. Profit and others [16] reported that bimaxillary surgery (maxillary advancement and mandibular setback) produced more stable results, but mandibular setback treatments alone produced less stable outcomes. They argued that the increased mean degrees of repositioning required in treatments limited to the mandible would ultimately increase the probability for recurrence as a way to explain this finding. However, no relapse was observed in this study even after mandibular orthognathic procedures. Scheuer und Höltje, by contrast, reported considerably better stability after procedures confined to the mandible than after bimaxillary procedures.[21] Cephalometric analysis can not to be used without clinical support, requiring facial analysis to complement and elucidate cephalometric data.[22] The analysis of facial assists in defining the movement necessary for obtaining the best result.[23] The analysis must include facial structures of the midface that does not show up in conventional cephalometric analysis like infraorbital rhyme, sub pupilar region, beyond the contour of the alar base that are important indicators of the anteroposterior position of the maxilla.[24] The balance between the muscular structures, bone, joint, dental and respiratory functions, speech, chewing and swallowing, is fundamental to the stability of the treatment.[25] The beauty is directly related to symmetry, noting a balance in size, shape and organization of anatomical features between opposite sides relative to a reference plane median. [26] The planning for orthognathic surgery should be performed more as an art form than science. Avoid the use of cephalometric values as treatment goal, without making the necessary adjustment to the patient. All these analyses should be critically evaluated with respect to the individual needs of each patient, and their complaints and desires should be a priority in the treatment plan. [27] The second follow-up examination in our study was conducted after a minimum of 1 and a maximum of 12 months. Adding longer observation periods (e.g., 24 or 36 months) are going to be a crucial goal in future investigations to verify the long-term stability of outcomes. The investigation results we obtained can be considered representative when considering other combined regimens of orthognathic surgery. Stable treatment outcomes were observed within the overwhelming majority of our treated patients with different orthognathic procedures during follow-up examinations.

The maxillary advancement procedures are more stable. The surgical correction of dentofacial deformities are both reliable and predictable. As with all surgical procedures, success demands the surgeon with an intimate knowledge and understanding of physiology and anatomy.

Kim and Park [5] indicated that post operative complications related to the recovery of sensation appeared in 65% of the cases, whereas Panula et al [13] reported that the main complication observed in the postoperative stage was sensorineural deficit in 32% of the patients. The outcomes that have been seen may alter if the definition of this variable has a bias and treats diminished sensation as expected or normal. In our series, the patient was directly questioned (after one week) about pain and decreased sensation as a postoperative consequence. Infraorbital par aesthesia observed in 4 patients, Bilateral mental nerve paresthesia present in 3 patients, unilateral mental nerve paresthesia present in 1 patient, Paresthesia present only over the lower lip in 1 patient and Paresthesia present over the right premolar region in 1 patient. (Table-4, graph-4)

Paresthesia resolved in all the patient except in 4 patients which was resolved after 2 months**.** (Table-4, graph-4)

In the same vein, according to McLeod and Bowe [20], infraorbital nerve damage would be extremely rare and the rate of persistent lingual nerve damage was 2 in every 100 patients. In a thorough assessment of ocular changes, Steel and Cope [16] described 9 patients with amaurosis who had been reported in the literature in relation to uncommon complications. No paralysis or severe harm like amaurosis was seen in our sample.

**Conclusions**

In the vast majority of our treated patients, stable treatment outcomes were seen during follow-ups. The techniques for maxillary advancement are more reliable. Dentofacial abnormalities can be surgically corrected in a reliable and predictable manner. As with all surgical procedures, success demands the surgeon with an intimate knowledge and understanding of physiology and anatomy.

Establishing nerve abnormalities as complications may be debatable because orthognathic surgery frequently results in them. Orthognathic surgery involves osteotomies, which may result in varying degrees of sensorineural changes. Three conditions are known to exist: complete recovery of sensation, imperfect recovery that may or may not cause the patient everyday difficulties, and final sensory loss.

Finally, based on our study, we can conclude that orthognathic surgery presents a low number of complications and is a relatively safe procedure when it is performed by a trained surgeon in train.

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