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Complications in Orthognathic Surgery: An Expeditious Appraisal

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Abstract---Orthognathic surgery is a aesthetic as well as functional correction surgery of jaw and face. Since it is an elective procedure it comes with its due benefits and complications. There should be a clear distinction between malpractics and complications. The complications could be foreseen if the cause is detected early and adequate treatment provided. The role of oral and maxillofacial surgeons comes into play with a proper understanding of the types,

causes and treatment of complications and should deliver this information to patients who develop these complications.

Keywords---complications, orthognathic surgeries, lefort 1 osteotomy, bilateral sagittal split osteotomy (BSSO), rare complications.

Introduction

Orthognathic surgery; also known as corrective jaw surgery is a procedure designed to correct conditions of the face and jaw; related to growth, TMJ disorders, sleep apnea, malocclusion, problems owing to skeletal disharmonies or other orthodontic problems that cannot be easily treated with braces. It corrects the facial aesthetics as well as the functions but despite of the corrections there are a lot of complications associated with orthognathic or corrective jaw surgery. Aesthetics is a prime concern for the modern-day patients and for that reason day by day newer and innovative techniques are used in orthognathic surgeries by oral and maxillofacial surgeons. Asian countries have higher incidence of prognathism than retrognathism, hence split sagittal osteotomy and vertical ramus osteotomy are the common procedures along with Le Fort 1 osteotomy.

An old surgical adage states: "If you have not had any complications, you have not done enough surgery yet". Despite of giving best results there are lots of complications associated with these procedures and the main complication is loss of sensory function due to damage to the inferior alveolar nerve. In sagittal split osteotomy this complication may arise either by direct or indirect injury. Direct injuries may be due to the trauma by the saw, drill and chisel and indirect injury may be due to the hematoma formation or due to oedema around the inferior alveolar canal. Sensory nerve injury may give symptoms such as anaesthesia, paraesthesia, hyperesthesia, hypoesthesia, and neuropathic pain.

Materials and Methods

A comprehensive literature review is an evidence-based practice method that involves analysing relevant studies to make decisions and improve care.¹ A review allows for the synthesis of the state of the science of a given subject because of its broad methodological scope. It can highlight gaps in the literature that need to be covered by performing new studies^{2,3}. A literature search was completed in October of 2019 using the Virtual Health Library PUBMED, EMBASE, Sciverse SCOPUS, and OVID portals, as well as the COCHRANE and CINHALL databases with Medical Subject Headings Section (MeSH) descriptors and Health Sciences Descriptors, and using the following search terms: Intraoperative Complications, Postoperative Complications AND Orthognathic Surgical Procedures and related complications.

Studies were selected mainly by their title and abstract. The inclusion criteria were studies found using the proposed search strategy that deal with the complications of the following surgical procedures: LeFort osteotomy; bilateral sagittal split osteotomy; maxillary segmental osteotomy; vertical osteotomy; and bimaxillary; surgically assisted rapid maxillary expansion and genioplasty. The

exclusion criteria were the following: studies discussing surgical techniques, complications during orthognathic surgery related to anaesthesia, surgical positioning, or any other complication not linked to the pre-operative, intra-operative and post-operative procedure; case studies or studies performed on cadavers or animals. Articles found in more than one database were analysed only once.

Results

Thirty-seven articles fulfilling the inclusion criteria were analysed. Only one was from the 1982s, while the rest were from the 2000s. The authors belonged to the same clinical specialty (oral and maxillofacial surgery), and the journals were from the fields of dentistry and oral and maxillofacial surgery. Most articles were found in the Journal of Oral and Maxillofacial Surgery. The volume of material published on the complications of orthognathic surgery is very large, which relates to both more common and more unusual events. In the same vein, a significant number of case reports or case series pertaining to the unusual were identified, overall showing a long list of complications of a wide range of forms and severities. A vast majority of studies located refer to the Le Fort I osteotomy, bilateral sagittal split osteotomy (BSSO). An overview of the more common complications is shown in Table 1, with other rarer complications listed in Table 2. These are discussed in detail in the main text. The unusual and rare complications identified by the search process will now be explored in more detail.

Table 1. COMMON COMPLICATIONS OF ORTHOGNATHIC SURGERY	Table 2. UNUSUAL/RARE COMPLICATIONS OF ORTHOGNATHIC SURGERY
<ul style="list-style-type: none"> • Postoperative nausea and vomiting • Temporary tympanomimetic changes • Acute infection • Chronic infection • Sinusitis • Excessive bleeding • Soft-tissue damage • Localized skin burns • Tooth injury • Loss of pulpal vitality • Periodontal disease • Gingival recession • Nerve exposure • Inferior alveolar nerve disturbance • Lingual nerve disturbance • Temporary taste disturbance • Instrument fracture 	<ul style="list-style-type: none"> • Injury to cranial nerves II, III, IV, V, VI, VII, VIII, X, XI and XII • Ophthalmoplegia • Neurosensory deafness • Secretomotor rhinopathy • Frey syndrome • Altered tear secretion • Hemolacria • Blindness • Adie pupil • Retrobulbar hemorrhage • Brain abscess • Actinomycosis • Bone graft donor-site infection • Osteonecrosis of maxilla/mandible • Avulsion of maxilla • Condylar dislocation • Condylar resorption (progressive, idiopathic, condylaratrophy) • Vomero-sphenoidal disarticulation • CSF leak

<ul style="list-style-type: none"> • Instrument/screw loss • Foreign body • Buccal/lingual plate fracture • Bad split • Incomplete/undesirable fracturing • Malunion • Condylar resorption • Temporomandibular joint effects • Relapse—skeletal and dental • Screw loosening • Instrument fracture • Respiratory difficulty • Neck pain • Malocclusion 	<ul style="list-style-type: none"> • Cerebrovascular accident (stroke, subarachnoid hemorrhage) • Severe hemorrhage • Arteriovenous fistula/false aneurysm/carotid-cavernous sinus fistula • Cavernous sinus thrombosis • Malignant hyperpyrexia/herniation of tube cuff/tube sectioning • Conversion disorder • Severe clinical depression • Acute pulmonary edema/apnea • Pneumomediastinum/pneumothorax • Surgical ciliated cyst • Traumatic neuroma • Dysphagia • Compartment syndrome • Perforated lateral nasal wall/septum • Oroantral/oronasal fistula • Loss of orthodontic bracket into airway • Severe eustachian tube malfunction • Ischemic finger injury • Death
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Discussion

Orthognathic surgery is define as a “Surgery performed by an oral and maxillofacial surgeon or a craniofacial surgeon to correct conditions affecting the jaw and face related to structural defects, growth and dysgenesis, sleep apnea, TMJ disorders, malocclusion problems owing to skeletal disharmony, or other orthodontic problems which cannot be easily treated with braces.” (Segen medical dictionary, 2012). Complications are broadly classified into 4 categories:

- Complications occurs due to lack of treatment planning
- Intra-operative complications
- Post-operative complications
- Rare complications

In the included studies, Complications that occurs due to lack of treatment planning are as follows:

- Relapse⁴⁻⁶

- gap between proximal and distal segment after sagittal split ramus osteotomy(SSO)⁷⁻¹⁴
- anterior open bite due to condyle malposition¹⁵
- clock wise rotation of proximal segment due to pterygomasseteric tension¹⁶
- worsening of temporomandibular disorders after surgery due to lack of treatment planning before the surgery¹⁷⁻²⁶
- Delayed union and non-union of osteotomy sites due to inadequate fixation²⁷
- changes of nasal morphology like nose widening and nose deviation following repositioning of the maxilla during surgery²⁸⁻³³
- psychological changes due to improper planning before surgery^{34,35}

According to studies that included in this review article complications arises intraoperatively are as follows:

- Excessive bleeding due to damage of descending palatine artery, sphenopalatine artery, pterygoid venous plexus, internal maxillary artery and its branches during Lefort 1 osteotomies.^{36,37} According to study excessive bleeding can also occurs due to damage of inferior alveolar artery and facial artery in SSO and rate of incidence varied between 0.39-38%.^{36,38}
- Inferior alveolar nerve injury most common during SSO and according to author the rate of incidence is in between 1.3-4%³⁹ and facial nerve injury ranges between 0.43-1.35%⁴⁰
- Vomero-Sphenoidal Disarticulation due to improper use of septal osteotome⁴¹
- Dental damage⁴²
- Bad Split during SSO⁴⁴⁻⁴⁷ incidence found in literature ranges from 1.7-9.1%⁴³
- Trigemino-cardiac Reflex incidence found in literature ranges from 1.6%⁴⁸⁻⁵⁰
- Reduction in lacrimal secretion due to damage to greater superficial petrosal and vidian nerves.⁵¹
- Excessive bending of miniplates during surgery cause fracture of plate
- Degloving injury to chin during genioplasty⁵²

In the included studies, Complications that occurs post operatively are as follows:

- Teeth discoloration due to ligation of descending palatine artery, genioplasty and mandibular subapical osteotomy⁵³
- Neurologic pain, altered mucosal, skin and teeth sensation due to damage of surrounding nerves⁵⁴⁻⁵⁶
- Neuropathic and musculoskeletal pain has been reported 21.4%⁵⁷
- Post-operative infection^{58-59,60-61}
- Hemorrhage⁶²⁻⁶⁸
- Blindness and Ophthalmoplegia due to ligation of maxillary artery⁶⁹
- Delayed, mal and non union^{70,71,72-73}
- Otitis media⁷⁴
- Lack of tear due to pterygoid plate fracture and damage of nerve⁷⁵⁻⁷⁶
- Periodontal problems⁷⁷

- Airway obstruction(AO) due to swelling, haematoma and sputum formation⁷⁸
- Snoring and obstructive sleep apnea due to hyoid bone position change⁷⁹⁻⁸¹
- Necrosis of bony segment due to ischemia⁸²
- Relapse^{4-6,8-14,15}
- Death due to AO and delayed secondary haemorrhage⁸³

In the included studies, rare complications that occurs during orthognathic surgery are as follows:

- Venous Thromboembolism due to vascular wall injuries, immobility, local hypoxia has been reported only 0.15%^{84,85}
- Pseudoaneurysm due to fibrosed blood vessels⁸⁶⁻⁸⁸
- Benign paroxysmal positional vertigo induced by vibrational energy that arises during orthognathic surgery^{89,90}
- Brain Abscess and incidence is 1 in 100000⁹¹⁻⁹³
- Massive epistaxis due to pseudoaneurysm of the sphenopalatine artery due to sharp trauma to vessel wall as a result of wrong direction of Osteotome positioning and manipulation^{94,95}
- Atelectasis and bilateral pneumothorax after bimaxillary orthognathic surgery caused by upper airway obstruction, drug-induced respiratory depression, or atelectasis. Management of atelectasis consists of spirometry and chest physio therapy and for pneumothorax intercostal tube drainage is used^{97,98}

Conclusion

There is a wide variety of complications associated with orthognathic surgery, including unusual complications that are hard to predict. There should be a clear distinction between malpractice and complications. Oral and maxillofacial surgeons must have a full understanding of the types, causes, and treatment of complications, and should deliver this information to patients who develop these complications. Malpractice should never occur, and is best prevented by careful and meticulous performance by surgeons. We believe that oral and maxillofacial surgeons who can confidently and perfectly manage postoperative complications are truly competent.

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