COMPLICATIONS ASSOCIATED WITH ORTHOGNATHIC SURGERY: A RETROSPECTIVE INSTITUTIONAL STUDY

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ABSTRACT

Orthognathic Surgery is performed in people affected by congenital or growth related or post traumatic craniofacial deformities who expect improvement in facial aesthetics and/or function. Restoration of deformities using surgical techniques carry an inadvertent risk of encountering complications ranging from physical to psychological shortcomings. The aim of this study was to identify and quantify the complications of orthognathic surgery based on the Clavien-Dindo Classification, among patients who underwent orthognathic surgical procedures in Saveetha Dental College and hospital. This hospital-based retrospective study was conducted at Saveetha Dental College, Department of Oral and Maxillofacial Surgery, Chennai, Tamil Nadu, from July 2019 to March 2020. Consecutive case records of all patients who underwent orthognathic surgical procedures were included in the study. Patients’ data was retrieved from the hospital digital data registry and the demographic details of the patients, type of orthognathic surgical procedure, and the postoperative complications were recorded. The Clavien-Dindo Classification which consisted of five grades was used to grade the postoperative complications. Statistical analysis was performed using the SPSS software (version 19.0; SPSS, Chicago, IL, USA). Descriptive statistics was done and chi-square tests were used to compare the categorical variables. Probabilities of P < 0.05 were considered statistically significant. In our study 20 patients were included. 7 patients underwent bi-jaw surgery and the remaining 13 underwent correction in a single jaw. Females underwent more orthognathic surgeries than males. The most frequent orthognathic procedures performed was Anterior maxillary osteotomy in maxilla followed by Bilateral sagittal split ramus osteotomy in mandible. In our study there was no statistically significant association observed between the type of orthognathic surgery performed and the postoperative complications observed. (p value - 0.209). 95% of the patients had Grade I complication of Clavien-Dindo Classification during their postoperative period and one patient had Grade II complication which was managed uneventfully by blood transfusion. Within the limits of this study, nerve injury was noted in higher frequencies in mandibular procedures. Although lip injuries, tooth injury, gingival recession and infection due to fixation material have also been reported, considering the severity, all
of them were categorised as minor complications. 95% of the postoperative complications were Grade I of Clavien-Dindo Classification. Though a higher rate of complication was observed in this study, they were only minor complications. It is imperative to have a good knowledge of complications associated with orthognathic surgery for refining the surgical procedures and to prevent the occurrence of such untoward sequelae in the future.

**Keywords:** orthognathic surgery; complications; bi jaw surgery; Le Fort I; BSSO; oral and maxillofacial surgery


**INTRODUCTION**

Orthognathic Surgery is surgical manipulation of the bones of the face to manage a wide range of abnormalities of the maxillofacial region that are due to congenital defects, developmental defects or acquired defects through trauma.(Abhinav et al., 2019) Historically, a stable repositioning of mandibles preceded the ability to reposition maxilla that led to a period where patients underwent mandibular surgeries predominantly, even to correct the defects of maxilla. The first surgery was performed by Simon. H. Hullihen in 1849 by placing osteotomy cuts in the mandible.(LaureanoFilho, Carvalho and Gomes, 2002) The key milestone in development of orthognathic surgery was marked after successful mobilisation of maxilla in a single step procedure in its predicted position in 1965. Simultaneous repositioning of maxilla and mandible was performed by Obwegeser in 1970. (Obwegeser, 1964) Over the years, the development of rigid fixation systems and improved surgical techniques led to increased success rates making it safer and receptive to the patients.(Sant’Ana and Janson, 2003). Treatment success is determined by interaction between multidisciplinary team consisting of Orthodontists, Oral and Maxillofacial Surgeons, Anaesthesiologists, nutritionists, physical therapists, audiologists, psychologists, speech therapist, nurses during all phases of treatment planning (pre-, intra- and post- operative periods)(Kumar and Rahman, 2017). It also plays a key role in ensuring patient safety and limiting complications.(Packiri, Gurunathan and Selvarasu, 2017; Marimuthu et al., 2018)

Any surgical procedure is subjected to complications and hence professional knowledge is required to avoid them.(Kumar, Patil and Munoli, 2015; Kumar and Sneha, 2016; Patilet et al., 2017) In order to provide appropriate care, rare complications must also be understood. A thorough understanding of the potential complications enables the multidisciplinary team to deliver safe care in the perioperative periods(Santhosh Kumar, 2017). Furthermore, complications are definitive in any surgical technique and are prevalent worldwide.(Sousa and Turrini, 2012; Kumar and Rahman, 2017) Thus, orthognathic surgery requires excellent knowledge and attention to the details of the patient's existing anatomy(Patturaja and Pradeep, 2016; Patilet et al., 2017). A failure in abiding to basic principles can lead to intraoperative complications like hemorrhage, vascular compromise leading to necrosis, relapse, malpositioning, neurosensory deficits, damage to dentition, periodontal defects, post operative nasal deformity.
Other complications anticipated are infection, fixation failure, malunion, devitalised teeth. (Bagheri, 2014)(Jesudasan, Abdul Wahab and MuthuSekhar, 2015)

The major risk factors associated are age, sex, presence or absence of third molars, duration of surgery, type of deformity, single or bi-jaw surgery and experience of the surgeon.(Stefanac and Nesbit, 2015) The Clavien and Dindo Classification grades the complications in an objective and reproducible manner. The basis of this classification is based on the therapy that is used to correct a specific complication. It has a total of 7 grades with subclasses ‘a’ and ‘b’ (I, II, IIIa, IIIb, IVa, IVb, and V). A potential long lasting complication leading to disability is marked by a suffix “d”, denoting ‘d’ for disability. It indicates the need for follow up and evaluate comprehensively on the long term quality of life. This classification system has been validated and accepted in various surgical fields. (Miyamoto et al., 2019) Adaptation of this system of classification has been reported previously by Zaroni et al, however, the system has no been widely used and its applicability, in this field remains unclear.(Zaroniet al., 2019)

The main objective of this study was to compare the postoperative complications following Orthognathic Surgery. We hypothesised that adapting the Clavien and Dindo Classification system would help elucidate the impact of surgical procedure performed on the incidence of postoperative complications.

MATERIALS AND METHODS

Study design and study setting

We conducted a hospital-based retrospective case-control study at Saveetha Dental College, Department of Oral and Maxillofacial Surgery, Chennai, Tamil Nadu, from July 2019 to March 2020. The study was initiated after approval from the institutional review board. (SDC/SIHEC/2020/DIASDATA/0619-0320).

Patient Population and Data Collection

A total of 20 patients who underwent orthognathic surgery at our centre from July 2019 to March 2020 were enrolled in this retrospective study. The study cohort included 8 men and 12 women with an average age of 27+/-8.3 years. Patients were excluded as study subjects based on the following: (1) Repeated admissions, (2) Incomplete information, (3) Patients undergoing complex Craniofacial Surgeries (Lefort II or III). The patients were divided into two groups based on the type of surgery that they underwent in Maxilla and Mandible. 7 patients underwent bi-jaw surgeries while the remaining 13 underwent single jaw surgery. Majority of the patients in the single jaw group underwent Anterior Maxillary Osteotomy (AMO), followed by Bilateral Sagittal Split Osteotomy (BSSO), Posterior Maxillary Segmental Osteotomy (PMSO), Genioplasty and Vertical Body osteotomy (VBO). Data on name, age, sex, and patient identification number (PID) were recorded along with the single/bi-jaw surgeries, type of procedure, medical complications and postoperative complications within 30 days after surgery. Postoperative complications analysed were classified based on Clavien-Dindo Classification and surgical complications were recorded.

Variables

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The dependent variable was incidence of complications which was further classified into medical and surgical related intra-operative / post-operative complications. The complications that were observed in the study sample were considered as mentioned below:

1. Lip Injury: Lip lacerations are most often iatrogenic in nature due to extensive retraction for longer duration or by frictional forces during surgical manipulation.

2. Nerve Injuries: Altered nerve sensations of lingual, mental, buccal, infraorbital, and facial nerves can occur due to neurosensory deficits caused by partial laceration or total nerve transection. (Panula, Finne and Oikarinen, 2001) (S. Kumar, 2017)

3. Nasal deformity: They can be caused by Le fort osteotomies where alar flaring occurs commonly but can be corrected by alar cinching.

4. Intra- or postoperative hemorrhage. Bleeding can be caused by rupture of maxillary artery and vein, pterygoid plexus, inferior alveolar or retromandibular artery or vein, palatine artery, or facial artery. It could be due to rupture of blood vessels and methods like hypotensive anaesthesia, anti-Trendelenburg position, direct pressure, vessel clamping, surgical packing or the use of topical hemostatic agents or electrocautery needs to be employed. (Acebal-Bianco et al., 2000; Teltzrow et al., 2005; Hoffman and Islam, 2008; Piñeiro-Aguilar et al., 2011; Iannetti et al., 2013; Christabelet et al., 2016) Intense bleeding during surgery leads to halt of procedure. Control needs to be established before continuing further. When blood loss exceeds the anticipated limits, hematocrit levels are assessed and blood transfusion is done. Postoperative hemorrhage refers to bleeding that occurs within 48 hours after surgery.

5. Dental injuries due to trauma to the teeth while performing osteotomies. (Jesudasan, Abdul Wahab and MuthuSekhar, 2015; Santhosh Kumar, 2017; Rao and Santhosh Kumar, 2018)

6. Periodontal injuries can range from gingival recession to weakening of teeth.

7. Failure of fixation screws and plates leading to infection. (Wahabet et al., 2017)

Independent variable such as sex, age, region and number of surgical site, type of osteotomy performed were collected. The number of surgical sites was evaluated as single or bi-jaw surgeries.

Types of osteotomies performed were classified as bilateral sagittal split osteotomy (BSSO), Vertical Body Osteotomy (VBO), Genioplasty, Anterior Maxillary osteotomy (AMO), Lower Subapical Osteotomy (LSO), Posterior Maxillary Segmental Osteotomy (PMSO) and Le Fort I with some of the patients undergoing more than a single type of osteotomy.

The Clavien-Dindo Classification was used to grade the postoperative complications. Grade I denotes any deviation from a normal postoperative course that is managed without the need of pharmacological treatment or surgical or endoscopic or radiological intervention. Drugs like antiemetics, antipyretics, analgesics, diuretics, electrolytes and physiotherapy were used to manage them. This grade is also inclusive of any wound infection that may require opening by the bedside. Grade II involves pharmacological management with drugs other than those employed in the management of Grade I. It includes blood transfusion and total parenteral nutritional supplements. Grade III is
defined as any complication that requires surgical, endoscopic or radiological intervention and is subclassified as ‘a’ and ‘b’ to code for the intervention performed without or with general anesthesia respectively. Grade IV refers to any life threatening complication that requires ICU management and is subclassified into ‘a’ and ‘b’ based on single/multi-organ dysfunction. Grade V refers to the death of the patient. (Miyamoto et al., 2019)

Statistical Analysis

Statistical analysis was performed using the SPSS software (version 19.0; SPSS, Chicago, IL, USA). Categorical variables were expressed as frequency and percentage; Continuous variables were expressed as mean ± SD. The chi-square test was used to compare the categorical variables. Probabilities of P < 0.05 were considered statistically significant.

RESULTS AND DISCUSSION

A surgical complication is any deviation from the normal intra or postoperative course. (Sweta, Abhinav and Ramesh, 2019) A complication is an anticipated outcome for any surgery. The prevalence rate of complications after orthognathic surgery varies between studies. Previous studies showed complication rates of 9.7% by Chow et al, 12.4% by Robl et al, 25.6% by lanetti et al and 19.2% by zaroni et al. (Chow et al., 2007; Robl, Farrell and Tucker, 2014; Grazianiet al., 2016; Vijayakumar Jain et al., 2019; Zaroniet al., 2019). Our study recorded a complication rate of 25% which could possibly due to the type of educational service the research is based on. All of the surgeries were performed by post graduate residents in Oral and Maxillofacial Surgery under the guidance of senior surgeons. All of the patients were assessed by collection of medical records, pre-surgical laboratory investigations, pre-anaesthetic evaluation followed by surgical planning performed by detailed examination, cephalometric analysis, model surgery by mounting on articulators.

A total of 20 orthognathic surgeries were performed during the study period. Women represented 60% (n=12) while men represented 40% (n=8) with a female: male ratio of 1.3:1. Females underwent more orthognathic surgeries than males. However the results were statistically not significant. (p=0.264)[Figure 1].

The mean age of the patients in our study was 27+/-8.3 years, with the majority (57%) of patients belonging to the age category of 21-30 years. A statistically significant association was present between age and gender of the patients. (p<0.001). Surgeries in both maxilla and mandible were equally performed like single jaw surgeries representing 40% each, followed by single jaw surgeries in mandible accounting for 20% of total cases. [Figure 2]. The most frequent orthognathic procedures performed in our study was Anterior maxillary osteotomy in maxilla followed by Bilateral sagittal split ramus osteotomy in mandible.

Complications occurred in 25% of cases during the postoperative period. The most frequent complications were Inferior Alveolar Nerve Injury (n=2) followed by alar flaring (n=1), both lip and mental nerve injury (n=1), gingival recession (n=1) infected fixation plate and screws (n=1) and tooth injury (n=1). There were no bad splits or condylar resorption or gross occlusal derangement. 95% of complications belonged to Grade 1 category. Grade II
complication was noted in one patient who underwent bi-jaw surgery consisting of BSSO, LSO, AMO and was later managed by blood transfusion.

According to Clavien-Dindo Classification for surgical complications 19 patients (11 females and 8 males) had Grade I complications and 1 female patient who underwent 3 procedures involving osteotomies had Grade II complication which was later managed by blood transfusion. There were no Grade III, IV or V complications in this study. In our study there was no statistically significant association observed between the type of orthognathic surgery performed and the postoperative complications observed. (p value - 0.209) [Figure 3]. Also in our study there was no significant association observed between the genders, age, number of procedures, the duration of the surgery and postoperative complications as observed in the previous studies. (Zaroniet al., 2019)

Neurosensory disorders are due to proximity of osteotomy sites in relation to the inferior alveolar nerve and mental nerve. These disturbances can be caused during various stages of surgery from the time of placement of incision, dissection, osteotomy, separation of segments or unfavorable splits leading to manipulation of the nerve bundle. The severity could range from transient loss caused by minor disturbances or insults to permanent loss of sensation caused by transection of the nerve bundle. In most cases, the recovery is spontaneous unless the insult is severe which may take a couple of months to 6 months for complete repair. (Agbaje et al., 2015).

CONCLUSION

Within the limits of this study, nerve injury was noted in higher frequencies in mandibular procedures. Although lip injuries, tooth injury, gingival recession and infection due to fixation material have also been reported, considering the severity, all of them were categorised as minor complications. 95% of the postoperative complications were Grade I of Clavien-Dindo Classification. Though a higher rate of complication was observed in this study, they were only minor complications. It is imperative to have a good knowledge of complications associated with orthognathic surgery for refining the surgical procedures and to prevent the occurrence of such untoward sequelae in the future. Thus, orthognathic surgeries performed in single or double jaws do not impose life threatening situations and can be performed safely promoting an added advantage for patients seeking cosmetic advances.

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CONFLICT OF INTEREST

Authors in this study did not have any conflict.
REFERENCES


Kumar, S. and Sneha, S. (2016) ‘Knowledge and awareness regarding antibiotic prophylaxis for infective


Figure 1: Bar chart depicting association between the number of jaw surgeries performed and gender distribution of the patients. X-axis represents the type of jaw surgeries performed and y axis denotes the number of orthognathic surgery patients in each gender. Pearson’s chi square test was done; p value: 0.264(>0.05) and the results were statistically not significant. Females underwent more orthognathic surgeries than males on the whole; however the results were statistically not significant.
Figure 2: Bar chart depicting the association between age and gender of patients undergoing Orthognathic Surgery. X axis denotes the various age categories and Y axis denotes the number of orthognathic surgery patients among males and females. Pearson’s chi square test was done; p value: 0.001(<0.05) and the results were statistically significant. Majority (57%) of patients were in the age category of 21-30 years.
Figure 3: Bar chart depicting the association between complications and the type of surgery. X axis denotes complication grade based on Clavien-Dindo Classification and Y axis denotes the number of orthognathic surgery patients in each type of surgery. Pearson’s chi square test was done; p=0.209 (>0.05) and the results were statistically not significant. Hence proving no association between complications and the type of surgery. 95% of complications belonged to the Grade 1 category.