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Orthognathic surgery: General considerations

Rajdeep Kaur
Assistant Professor,Department of Orthodontics & Dentofacial Orthopaedics, Desh Bhagat Dental College & Hospital, Desh Bhagat University, Mandi Gobindgarh
Email: dentistchahal@gmail.com

Sanjeev Soni
Professor & Head, Department of Orthodontics & Dentofacial Orthopaedics, Desh Bhagat Dental College & Hospital,Desh Bhagat University, Mandi Gobindgarh

Anil Prashar
Professor,Department of Orthodontics & Dentofacial Orthopaedics, Desh Bhagat Dental College & Hospital,Desh Bhagat University, Mandi Gobindgarh

***Abstract*---**Orthodontic treatment goals can be divided into five categories: facial esthetics, dental esthetics, functional occlusion, periodontal health, and stability.Orthognathic surgery is a unique endeavor in facial surgery: a patient's appearance and occlusal function can be improved significantly, impacting the patient's sense of self and well-being. Successful outcomes in modern orthognathic surgery rely on close collaboration between the surgeon and the orthodontist across all stages of treatment, from preoperative planning to finalization of occlusion. Virtual computer planning promotes a more accurate analysis of dentofacial deformity and preoperative planning. It is also an invaluable aid in providing comprehensive patient education.

***Keywords*---**orthognathic surgery, dentofacial deformity, malocclusion.

Introduction

Skeletal dentofacial deformities are associated with numerous problems including: esthetic, functional, psychological, speech, mastication, digestion, and possible temporomandibular joint dysfunctions. Orthognathic surgery is a hospital based operation in which the elements of the facial skeleton are manipulated to restore the proper anatomic and functional relationship in patients with skeletal dentofacial deformities and overcome the above mentioned

problems. The results of orthognathic surgery can have dramatic and positive effects on many aspects of the patient's life.

Orthognathic surgery to reposition the maxilla, mandible, or chin is the mainstay treatment for patients who are too old for growth modification and for dentofacial conditions that are too severe for either surgical or orthodontic camouflage. Today's orthognathic surgical treatment for dentofacial deformity consists of standard orthognathic procedures to correct jaw deformity, as well as adjunctive procedures to improve hard and soft tissue contours. These adjunctive procedures include an osseous versus alloplastic genioplasty, septorhinoplasty, and suction lipectomy of the neck. A collaborative approach between the orthodontist and maxillofacial surgeon is imperative to successfully devise and execute a comprehensive treatment plan with predictable outcomes.[1]

Based on the severity of the misalignment and the position of the jaw, jaw surgeries are classified into different types of:

- Maxillary osteotomy (Upper Jaw Surgery)
- Mandibular osteotomy (Lower Jaw)
- Genioplasty (Chin Surgery)
- Arthroplasty (keyhole surgery.
- Arthrocentesis.

Sequence of Treatment

Advances in orthognathic surgical treatment planning and in techniques for complex, simultaneous maxillary and mandibular repositioning have resulted in improved surgical accuracy. In traditional surgical sequencing, maxillary surgery is performed first; the maxilla is set, with or without an intermediate splint, using external reference points to verify and/or determine appropriate movement. However, errors in model surgery and intermediate splint fabrication can lead to surgical inaccuracy despite good surgical technique. In repositioning the maxilla first, when thin bony walls are present, and/or in conjunction with large mandibular advancements, maxillary shifting may occur when maxillomandibular fixation is applied. Soft tissue tension and surgical manipulation in this sequencing technique may result in a less desirable functional and esthetic outcome.[2]

Psychologic Preparation

Psychological factors should be strongly weighed by both treating surgeon and orthodontist. It is imperative for the treating team to understand the patient's underlying motivation to seek treatment for correction of skeletal jaw deformity, the psychosocial impact of the condition, and the psychosocial response to treatment. It is key to anticipate and match patient's expectations to the proposed treatment plan. It is equally important to counsel the patient about surgical sequelae, common complications, period of recovery, and the expected course of rehabilitation. The patient should be informed about the abrupt shifts in lifestyle that occur for the first 4 to 6 weeks following the operation. Most patients will suffer through a period of acute mood shifts (depression) in the early

postoperative period. This acute mood disturbance is typically short lived in most patients, lasting only a few days. Patients should be forewarned about the possibility of a postoperative mood change. Some patients, in whom postoperative depression or difficulty with adjustment with new facial appearance persist, may require a referral for specialized professional counseling. Psychological preparation of the patient is critical and consists of good rapport; continued, open dialogue between patient, orthodontist, and surgeon; and thorough patient education. This helps the patient stay informed and to be better equipped to anticipate the major changes in jaw function and facial aesthetics that are brought about by orthognathic surgery.[2]

Most patients can expect to return to school or work within 10 to 14 days following an operation. Although postoperative facial edema is highly disturbing to most patients, acute facial edema typically resolves in the first 3 weeks after surgery. With rigid internal fixation (RIF), early jaw function promotes diminution of residual edema by 6 to 8 weeks postoperatively.

Patient Management at Surgery

Preservation of Blood Supply

Bell's pioneering work in experimental animal model established the biologic basis for preservation of blood supply to mobilized bony segments, soft tissue, and teeth (dental pulp and periodontal ligament) through maintenance of attached soft tissue pedicle.[3] As a general rule, it is not recommended to create more than four dentoalveolar segments within a single arch; it is also unwise to have only a single tooth in a mobilized skeletal segment. Penetrating vessels from mandibular elevator muscles preserve the blood supply to the segments that result from ramus osteotomies. Minimizing subperiosteal stripping in the posterior mandible is recommended.

Protection of Teeth, Bone, and Neurovascular Structures

With mandible procedures, protection of lingual, inferior alveolar, and facial nerves is important during surgical approach and osteotomy. Teeth in osteotomized and mobilized skeletal segments are at risk for devascularization. Teeth that are adjacent to osteotomy sites are at greatest risk. Preservation of periodontal ligament space during an interdental osteotomy prevents postoperative dental ankylosis. Presurgical orthodontic preparation should leave 3 to 4 mm of bone between tooth roots where an interdental osteotomy is planned. Transverse osteotomy cuts should be kept at least 3 to 5 mm away from root apices to preserve vascular supply to the dental pulp. Alveolar segments should be positioned to preserve equal and consistent vertical height among segments to minimize the risk of postoperative periodontal pocketing and attendant bone loss.

Nutrition

Adequate protein and caloric intake is vital in the postoperative period to counteract catabolic metabolism that ensues as a reaction to the stress of an operation. The patient's nutritional requirements increase at the same time as the

function of the jaws is temporarily impaired. Prolonged postoperative maxillomandibular fixation exacerbates the problem. Reasonable goals for caloric and protein intake are 2500 to 3000 calories per day and 1 to 1.5 g protein/kg body weight/d. Supplementation with protein shakes or nutritionally complete liquids may be required. Body weight is typically used as a guide for adequate fluid and nutrition intake. Inpatient consultation by a dietitian may be indicated. Having a designated caregiver who supervises and monitors the patient's caloric and fluid intake is helpful.[3]

Complications of Orthognathic Surgery

Overall, orthognathic surgical treatment is safe when executed by a well-trained, experienced surgeon in a center that performs a large volume of such cases. Some of the complications and risks of orthognathic surgery are detailed below. This is not an exhaustive list, but rather represents the most salient factors that should be considered by the surgeon and discussed with the patient.

Blood Loss

Because orthognathic surgery to correct facial disproportion is performed as an elective procedure, the surgical team should make every attempt to control blood loss and reduce the need for blood transfusion. Hypotensive anesthesia leads to decreased blood loss and overall improved quality of the surgical field.[5] A blood transfusion is rarely necessary for routine single-jaw operations. However, nearly 30% of double-jaw procedures require blood transfusion.[6] Hegtvedt et al reported that nearly 26% of patients having isolated maxillary surgery required one or more packed red cells.[7]

In a healthy patient, a mean arterial pressure (MAP) of 50 to 60 mm Hg is considered to represent a safe lower limit of induced hypotension. The reduced need for blood transfusion with hypotensive anesthesia potentially eliminates the risk for transfusion reaction or transmission of blood-borne pathogens. Profuse hemorrhage is rare with mandibular osteotomy. In rare instances, during a Le Fort I maxillary osteotomy, uncontrolled hemorrhage from transection of the descending palatine artery during downfracture of the maxilla, or laceration to the internal maxillary artery or pterygoid plexus at time of pterygomaxillary disjunction may require selective angiography with embolization. Some authors recommend that any patient undergoing LeFort I maxillary osteotomy be offered the option of predepositing one unit of blood for subsequent autologous blood transfusion.

Infection

Infection is surprisingly rare in patients undergoing orthognathic surgery. Administration of prophylactic intraoperative antibiotics, intravenous antibiotics during the hospital stay, and a course of oral antibiotics on hospital discharge represent routine practice in most orthognathic surgical practices.

Nerve Injury

Injury to the infraorbital nerve during a Le Fort I osteotomy or the inferior alveolar nerve during a sagittal split osteotomy of the mandible typically represent a neurapraxia. Injury to the facial or lingual nerve during mandible surgery is rare. The infraorbital or inferior alveolar nerves may be stretched or contused, but are rarely lacerated or avulsed. Return of sensibility is dependent on the type of injury and variations in patient's individual healing.

Skeletal Relapse and Postoperative Malocclusion

With the advent of rigid internal fixation across the osteotomy site, uncontrolled skeletal relapse is unlikely to occur. Skeletal remodeling at the site of osteotomy and the mandibular condylar heads may continue up to 6 to 12 months postoperatively. Acute, unanticipated malocclusion that is noted in the early postoperative period usually reflects inaccurate positioning and fixation of skeletal segments. Occasionally, this finding of early malocclusion may require return to the operating room for removal and reapplication of rigid internal fixation.

At the time of the sagittal splitting of the mandible, it is imperative to accurately position the proximal mandibular segment prior to application of fixation. The proper positioning of the proximal segment, although critical in establishing the correct skeletal position of jaw segments, is largely dependent on an individual surgeon's experience, expertise, and “feel.” When a Le Fort I osteotomy is performed, the most likely cause of immediate postoperative malocclusion and an early anterior open bite is improper seating of the mandibular condyles in the glenoid fossa at the time of application of internal fixation across the maxillary osteotomy site.

Temporomandibular Joint Pain or Degeneration

Patients with dentofacial deformity and malocclusion have a higher incidence of temporomandibular joint (TMJ) derangements (popping, clicking, reduced range of motion, and pain) than the general population.[8] In general, patients should be carefully counseled that the effects of orthodontic treatment or orthognathic surgery on amelioration or worsening of TMJ symptoms is largely unpredictable. Progressive condylar resorption is a rare cause of long-term relapse that may follow an isolated maxillary or mandible procedure or bimaxillary surgery. The cause of progressive condylar resorption is poorly understood, but is more frequently observed in young female patients with pre-existing Angle Class II skeletal pattern.

Unfavorable Fracture at the Sagittal Split Osteotomy Site

Overall, the rate of unfavorable fracture of the ramus or condyle of the proximal segment during sagittal splitting of the mandible is rare and is usually quoted as less than 2%. When it occurs, this complication is a result of malformed bone with poor stock or is a technical complication. The “bad split” should be essentially approached as a fracture and treated with reduction and internal

fixation. Patients should be counseled preoperatively about the possibility of this complication and its attendant prolonged recovery and possible need for a second operation.

Conclusion

Orthognathic surgery relies on a close collaboration between the surgeon and the orthodontist across all stages of treatment, from preoperative planning to finalization of occlusion. Virtual computer planning promotes a more accurate analysis of dentofacial deformity and preoperative planning. It is also an invaluable aid in providing comprehensive patient education.

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