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CondylarSag after Bilateral Sagittal Split Ramus Osteotomy: A Review

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ABSTRACT: Orthognathic surgery procedures are frequently used to correct Angle's skeletal class II and class III deformities, dentomaxillofacial deformities, mandibular laterognathia, and maxillofacial asymmetries. As with any surgical procedure, various preoperative, intraoperative, and postoperative complications may occur. The primary goal of split sagittal ramus osteotomy (SSRO) was correction of mandibular skeletal malocclusions. Split sagittal ramus osteotomy (SSRO) has less inter-maxillary fixation (IMF) period and improved patient comfort are advantages of this technique. Malocclusion after orthognathic surgeries (BSSO, IVRO, Le-fort I osteotomy) may be the result of failure of rigid fixation at the osteotomy site, occlusal shifts during fixation or improper condylar position. Condylar sag is most challenging to diagnose and treat correctly.

Muscle tone, muscular activity, and proprioception appear to have important roles in the clinical evidence of a postoperative malocclusion during the intraoperative awakening; they can reliably implement the accuracy of the diagnosis of condylar sag, and they can favour its correction. Meticulous examination of the occlusion and an understanding of the occlusal changes secondary to condylar sag can reliably identify condylar sag intra-operatively. The use of suitable corrective measures during the primary operation can substantially reduce the postoperative complication rate of condylar sag.

KEYWORDS: Orthognathic surgery, Condylar sag, BSSO, IVRO, Le-Fort I osteotomy, Complications.

I. INTRODUCTION

Orthognathic surgery procedures are frequently used to correct Angle's skeletal class II and class III deformities, dentomaxillofacial deformities, mandibular laterognathia (lateral cross bite of individual or all side teeth with mandibular dislocation), and maxillofacial asymmetries.(1)As with any surgical procedure, various preoperative, intraoperative and postoperative complications may occur.

Mandibular osteotomy was first introduced as anterior sub apical osteotomy. It improved when Laterman and Caldwell proposed the Intraoral Vertical Ramus Osteotomy (IVRO). However, it was Obwegeser and Trauner who first developed sagittal splitting ramus osteotomy (SSRO). The primary goal of SSRO was correction of mandibular skeletal malocclusions. SSRO has less inter-maxillary fixation (IMF) period and improved patient comfort are advantages of this technique. (2) The sagittal split ramus osteotomy of the mandible is a versatile surgical procedure that can be used to correct many skeletal and functional maxillofacial deformities. However, authors in the past 15 years have addressed the problems associated with the improper postoperative position of the proximal or condylar segment of the mandible. The general concern has been that the proximal segment should be maintained in its correct anatomic and preoperative position following the surgical positioning of the distal, or tooth bearing, segment and fixation of the mandible. Failure to correctly position the proximal segment can result in a built-in relapse potential, loss of the gonial angle, condylar sag, pain and dysfunction of the temporomandibular joint, and functional impairment of the masticatory system.

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Malocclusion after orthognathic surgeries (BSSO, IVRO, Le-fort I osteotomy) may be the result of failure of rigid fixation at the osteotomy site, occlusal shifts during fixation or improper condylar position.

Condylar sag is most challenging to diagnose and treat correctly. The most troublesome sequalae are skeletal instability and anteroinferior condyle displacement (sag) with resultant unpredictability of the postoperative mandibular position. The term condylar sag was coined by Hall et al. in 1975. They described the influence of the condylar position on postoperative occlusal stability following the release of IMF.(3)

Condylar sag can be defined as an immediate or late change in position of the condyle in the glenoid fossa after surgical establishment of a pre-planned occlusion and rigid fixation of the bone fragments, leading to a change in the occlusion.(4)

COMPLICATIONS (4)

Complications following Orthognathic surgery ranges from 9.7-24.5%, Neural deficit (most common) -50.42%, TMJ Dysfunction- 13.64%, Hemorrhage - 9.09%.

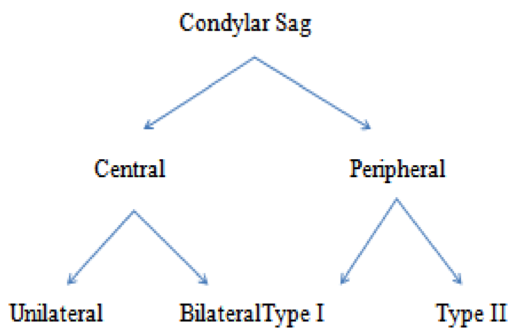
RISK FACTORS

Incorrect vector during condylar positioning: An incomplete or green-stick split that prevents condylar seating: Muscular, ligamentous, or periosteal interference: Intra-articular haemorrhage or edema and flexing the proximal segment while placing rigid fixation. (4)

Condylar sag after bilateralintraoral vertical ramus osteotomy (IVRO) has clinical significance and is associated with improved mandibular function.

Five Condylar sag is a frequent finding after an IVRO. Immediately following surgical procedure, the condyles are positioned inferiorly and anteriorly within the glenoid fossa. During the postoperative follow-up period, superior and posterior repositioning of the condyle occurs gradually.

TYPES (4)



Central condylar sag occurs when the condyle is positioned inferiorly in the glenoid fossa and makes no contact with any part of the fossa. After removal of the IMF and in the absence of intracapsular edema or hemarthrosis, the condyle will move superiorly causing a malocclusion.

Peripheral condylar sag (type I) occurs when the condyle is positioned inferiorly with peripheral contact with the fossa (lateral, medial, posterior, or anterior), while the IMF is in position and the teeth are in occlusion. Delayed occlusal relapse occurs as a result of condylar resorption or change in its shape. Peripheral condylar sag (type II) occurs when the condyle is positioned correctly in the fossa while IMF is in position and the teeth are in occlusion; however, the incorrect placement of rigid fixation causes flexural stress in the proximal segment. Once the IMF is removed, the tension in the proximal segment is released and the condyle moves eitherlaterally or medially and slides inferiorly.

II. DISCUSSION

The first records of the use of Le Fort I osteotomy and bilateral sagittal split mandibular osteotomy (BSSO) procedures for the correction of mid-facial deformities were described in the 1920and in 1953(1), respectively. The earliest article describing complications associated with such a procedure dates back to 1979(5). The rate of reported complications has gradually increased with time, from only one study in 1979 to 14 studies in 2012, as orthognathic surgery has become more widely accepted, and is now a frequently performed surgical method for correcting maxillomandibular dysmorphoses. However, the total number of complications might be underestimated because surgeons may be unable to easily report the complications due to their own professional obligations and involvement.

According to the articles obtained in our search, the most commonly reported complication was cranial nerve injury/ sensitivity alteration

(50.00 %). Following orthognathic surgery, patients may encounter laceration or disruption as also stretching of the cranial nerves, especially the inferior alveolar nerve (IAN) during BSSO. Neurophysiologic examination with electroneuromyography enables the exact classification of nerve injury into either the axonal or demyelinating type, which allows the accurate prediction of recovery and the risk of neuropathic pain[(6)]. Demyelinating nerve injury recovers completely within 2 to 4months along with remyelination, and it very seldom induces neuropathic pain.

The subjective symptoms of altered sensation were classified according to the general sensory system dysfunction classification into three categories: normal symptoms (nerves with no subjective alteration), negative sensory symptoms (hypoesthesia), and positive sensory symptoms (parasthesia, dysasthesia, and/or pain). [(7)]

Methods for testing sensory nerve function can be divided as follows: qualitative (touch sensation, sharp/blunt test, cold sensation, and hot sensation) and quantitative methods (localization test, two point static methods for testing sensory nerve function can be divided as follows: qualitative (touch sensation, sharp/blunt test, cold sensation, and hot sensation) and quantitative methods (localization test, two point static, and dynamic test). [(8)]

Researchers usually measured sensory impairment immediately after surgery, after 3rd, 6thmonths, and after 1 year. Philips et al. reported that immediately after surgery almost all patients reported altered sensation. Most cases of paraesthesia resolved within 1 year, but not all[(8)]. Henzelka et al. found that approximately 3% of patients may suffer from paraesthesia even 1 year after surgery. The same authors found a significantly higher prevalence of paraesthesia on the left side [(9)].

Further risk factors for inferior alveolar nerve injury and impairment are the following: (1) patient's age; (2) length of procedure; (3) experience of the surgeon; (4) the type of procedure [ILRO (Inverted L Ramus Osteotomy) seems to be a better choice than the BSSO method]; (5) mandibular advancement >10 mm; (6) type of fixation (bicortical fixation seems to be a risk factor for nerve injury or compression); (7) the surgical space on the medial side of the mandibular ramus and the subsequent manipulation of the inferior alveolar nerve in that region; and (8) the tactile sensory threshold before surgery (patients with low sensory thresholds before BSSO experienced a higher degree of impairment after surgery compared with those with higher preoperative thresholds) [(1)]

Condylar sag produces repeatable patterns of occlusal shift that assist in identifying the offending condyle. Occlusal alterations can be identified by careful clinical examination after the removal of IMF. Reyneke and Ferretti[(10)] described a method of intraoperative diagnosis of condylar sag based on digital pressure on the chin, rotating the mandible until its first occlusal contact, and then checking the occlusion; but they recommended, "the temptation to force the teeth into occlusion by increasing the digital pressure must be resisted. It should be kept in mind that only a light force is necessary to displace the condyles out of the fossa, which could deceive the surgeon into thinking that a correct occlusion had been achieved." Testing the occlusion with the patient's autonomous mandibular closure, this problem is overcome.

PREVENTION OF CONDYLAR SAG

Early relapse due to improper condylar positioning during rigid fixation continues to be a problem. Malocclusion after BSSO may be the result of failure of rigid fixation at the osteotomy site, occlusal shifts during fixation and, finally, condylar sag. Condylar sag is the most challenging to diagnose and treat correctly. Our understanding of postoperative changes in condylar position and shape and their influence on surgical stability has increased considerably over the past 2 decades. This has been facilitated by the increasing use of sophisticated imaging techniques. These investigations are all done postoperatively. Condylar positioning devices have led to longer operative times, the necessity to keep intermaxillary fixation as stable as possible during their application, and the risk of partial bone disruption of the maxilla. Their use has also caused the need for precision during the construction of the splint or intraoperative wax bite, and the prevention of mandibular auto-rotation. Therefore, their use is controversial and their indications are still under discussion. [(11,12)]

Sonography was used with a vertical probe position for intraoperative monitoring of positioning of the proximal fragment. [(13)] The probe required multiple adjustments to follow the condylar translation. A non-visibility of the condyle in open mouth and dislocated position resulted, as well as only a rough reproduction of the anatomic structures.

The empirical method is the most widely used way to reposition the condylar fragment after a mandibular osteotomy. It consists of manually trying to place the condyle in its most superior and anterior position in the glenoid cavity (14); the quality of the procedure is closely related to the operator's experience.

Boucher and Jacoby (15) found that the anesthetized or paralyzed patients had a condylar position 2 mm posterior to that in the same patients when they were awake with the same seating force applied. Their conclusion was that the posterior border position is defined by muscular action, primarily that of the lateral pterygoid.

III. CONCLUSION

Muscle tone, muscular activity, and proprioception appear to have important roles in the clinical evidence of a postoperative malocclusion during the intraoperative awakening; they can reliably implement the accuracy of the diagnosis of condylar sag, and they can favour its correction. Meticulous examination of the occlusion and an understanding of the occlusal changes secondary to condylar sag can reliably identify condylar sag intra-operatively. The use of suitable corrective measures during the primary operation can substantially reduce the postoperative complication rate of condylar sag.

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