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Assessment of Temporomandibular Joint Disorders Following Orthognathic Surgery: A Literature Review

Ramvihari Thota*, Senthilnathan Periasamy

Department of Oral & Maxillofacial Surgery, Saveetha Dental College, Saveetha Institute of Medical and Technical Science, Saveetha University, Chennai, India

ABSTRACT

The objective of this review is to assess the TMJ disorders following Orthognathic surgery, TMJ disorders are multifactorial and have symptoms such as limitation in range of motion of mandible, pain on mastication relating to masticatory muscles and TMJ, joint sounds such as clicking & crepitus, myofascial pain and limitations in other functions. A review was conducted and searched three major databases to locate all pertinent articles published from 2000 to March 2020. All subjects in the various studies were stratified based on sub diagnoses of TMDs. The predictor variables were those patients with pre-existing TMDs that underwent orthognathic surgery in various subgroups. The outcome variables were maximal mouth opening (MMO) and signs and symptoms of a TMD before and after orthognathic surgery based on the type of osteotomy. The patients with Dentofacial deformity undergoing Orthognathic surgery have its impact on TMJ, muscles of mastication and surrounding tissues and the associated TMJ symptoms directly. Therefore, pre-existing symptoms of TMJ should be considered before planning treatment and orthognathic surgery. There was a significant difference in patients with prognathism after isolated BSSO or intraoral vertical ramus osteotomy (IVRO) and for combined BSSO and Le Fort I, but no significant difference after BSSO or bimaxillary surgery (IVRO and Le Fort I. Orthognathic surgery caused a decrease in TMD symptoms for many patients who had symptoms presurgery but created symptoms in a smaller group of patients who were asymptomatic presurgery. The presence of presurgery TMD symptoms or the type of jaw deformity did not identify which patients would improve, remain the same, or worsen after surgery.

Key words: Orthognathic surgery, TMJ, OGS, TMD, Temporomandibular joint

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Corresponding author: Ramvihari Thota
e-mail✉: ramvihari7@gmail.com
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INTRODUCTION

A dentofacial deformity is an imbalance of position, size, shape or orientation of bones that comprise the upper and lower jaws & is multifactorial with genetic predisposition, environmental factors, trauma/infection in childhood, parafunctional habits, condylar hyperplasia, mandibular hypoplasia, previous surgical procedures or temporomandibular joint disorders. These patients require OGS for better facial profile & correction of skeletal asymmetry and treating malocclusion [1-3]. There is controversy as to the appropriate management of patients with pre-existing internal derangement of the temporomandibular joint (TMJ) who require orthognathic surgery for the correction of malocclusion and jaw deformities. There are 2 significantly different philosophies: although some investigators contend that orthognathic surgical procedures help in the reduction of TMJ dysfunction and symptoms, other researchers have shown that orthognathic surgery in such patients causes further deleterious effects on the TMJ and thus worsens the symptoms and dysfunction post-surgery.

Orthognathic surgery is known well for its surgical intervention to change and/or correct the structure related to the face. OGS can be roughly divided into maxillary, mandibular and combined. OGS covers a set of techniques to correct maxillofacial discrepancies, most used are BSSO (bilateral sagittal split osteotomy) established by Obwegeser et al. [4]. Dentomaxillofacial deformities involve dentoalveolar and skeletal modification which usually require orthodontic treatment combined with orthognathic surgery. BSSO is described as complete osteotomy of mandibular ramus superior to mandibular foramen allowing advancement or repositioning of mandible. Other common surgical strategies are Vertical ramus osteotomy, surgically assisted rapid maxillary expansion, mandibular midline distraction, Lefort I osteotomy and bimaxillary osteotomy. The TMJ response ranges from bone remodelling to complications which are irreversible. As TMJ disorders are multifactorial and have a wide range of individual variabilities other physical and psychological factors should also be considered. The second philosophy proposes surgical management of the TMJ pathology at an initial separate procedure or concomitantly with the orthognathic surgery. This dichotomy of opinion has created confusion in our specialty as to the management of these patients.

Nickerson et al. [5] showed that displacement of the articular disc may lead to a cascade of events resulting in degenerative joint disease. However, some practitioners advocate orthognathic surgical procedures for correction of TMJ symptoms on the premise that improvement in occlusal relationship and reduced emotional stress result in a decrease in TMJ symptoms after surgery. Karabouta et al. [1] evaluated 280 patients with various mandibular deformities for incidence of TMJ symptoms and found that the highest incidence of TMJ symptoms was present in retrognathic patients. They performed sagittal split osteotomies with 10 to 12 weeks of intermaxillary fixation on 114 of the 280 patients (only 23 had mandibular advancements) and reported that 88.9% had relief of TMJ symptoms post-surgery. However, all postsurgical evaluations were done at 6 months, and no long-term follow-up data were presented. Magnusson et al [6] evaluated 20 patients with a follow-up range of 1 to 21/2 years and concluded that orthognathic surgery had beneficial effects on TMJ dysfunction. They did not mention the nature of mandibular surgery performed (advancement versus setback). Upton et al [4] reported on 55 patients with pre surgical TMJ dysfunction; 78% of patients reported improvement in symptoms post-surgery, 16% reported no change, and only 3% reported an increase in TMJ symptoms. However, the study was based only on a questionnaire sent posttreatment asking patients to rate their presurgical and postsurgical symptoms, and less than 50% of the patients responded. No defined length of follow-up time post surgery was mentioned, nor was any clinical or radiographic data included in the report. These reports support the viewpoint that routine orthognathic surgery can improve TMJ symptoms in patients with pre surgical TMJ internal derangement.

Onizawa et al [7] investigated alterations in TMJ dysfunction in patients at 3 and 6 months after orthognathic surgery by comparing the surgical patients with healthy volunteers, and they concluded that changes in TMJ symptoms post-surgery are not due to correction of malocclusion but rather to alterations on factors such as the influence of the surgery on the masticatory muscles. Moore et al [8] reported on 5 cases of condylar resorption after orthognathic surgery, with 3 of the 5 patients having known presurgical joint dysfunction.

Arnett et al. [9] presented 10 cases of condylar resorption where all patients had a history of presurgical TMJ dysfunction and 9 of the 10 patients were identified as having increased loading of the TMJ that preceded or accompanied the condylar resorptive changes. Continued mandibular retrusion due to progressive condylar resorption was seen in 6 of the 9 patients (66%) who underwent orthognathic surgery. Crawford et al10 presented 7 cases of condylar resorption after orthognathic surgery. They stated that the disease has a predilection for females with pre-existing TMJ disease in whom large advancements were performed. Nitzan et al. [10] reported on 8 cases of fibrous ankylosis in patients who had undergone mandibular orthognathic surgery. Four of the patients had known presurgical TMJ dysfunction. Harper et al. [11] analysed presurgical and postsurgical axiographic condylar pathway tracings in 24 patients with presurgical internal derangement who underwent mandibular advancement surgery and found that only 4 patients (17%) developed normal condylar pathway tracings after surgery.

Pre-existing TMJ disease with condylar resorption has been implicated as a factor in skeletal relapse after mandibular advancement surgery. Other factors predisposing to skeletal relapse and condylar resorption are age and gender of the patient; high mandibular plane angle; preoperative orthodontic treatment; bone healing; condylar positioning; neuromuscular adaptation; instability of segments; and the amount of mandibular advancement performed. Satrom et al. [12] showed that mandibular advancement in double-jaw surgery (with or without counter clockwise rotation) using rigid fixation with healthy TMJs is a stable procedure in the long term, with a mean anteroposterior relapse at point B of 6%, regardless of the amount of surgical advancement. Other studies have shown that there is no significant difference in the prevalence of TMJ symptoms between patients who have received rigid internal fixation versus nonrigid wire osteosynthesis during bilateral sagittal spilt osteotomies for mandibular advancement.

The main indications for orthognathic surgery are to minimize time of treatment, functional improvement, time conservation and achieve stability after orthodontic correction, and aesthetic improvement7. The purposes of this study were to assess changes in TMJ in patients who underwent orthognathic surgery and to evaluate the long-term stability of the orthognathic surgical procedures performed.

METHODS

An electronic search was done in databases of PubMed, Google scholar, Science Direct and related articles were collected with search words TMJ, Orthognathic surgery. The search was limited to human studies.

All the studies did retrospective studies but with different approaches like questionnaires, clinical examinations, radiographic examinations. Total number of subjects were different in respective approaches like 176, 25, and 57.

Questionnaires are related to Noises related to TMJ during functioning, Pain in TMJ, limitation of mouth opening, jaw locking, feeling of tenseness on mouth opening, clicking of jaws pre and post surgically.

Clinical examination includes subjective pain symptoms, TMJ pain, TMJ sounds, range of TMJ motion and occlusion. Self-assessment done by patients on visual analogue scale for evaluation of TMJ pain and joint function where 0 indicated as no pain and 10 as unimaginable worst pain. Clinical examination included evaluation for pain, noises and range of motion related to TMJ and occlusal relationship.

Radiographic evaluation includes Lateral cephalograms, Lateral cephalometric TMJ tomograms and CBCT for volumetric evaluation. Spaces measured using CBCT are anterior joint space (distance between articular fossa and anterior most point on the condyle), superior joint space (distance between articular fossa and superior most point on condyle), posterior joint space (distance between articular fossa and posterior most point on condyle), medial joint space(distance between articular fossa and medial most point on condyle) which are checked for each condyle individually. For volume measurements, each condyle is reoriented individually for examinations [12].

RESULTS

Results showed out of 176 patients only 57 patients returned their questionnaire forms. After investigating, results showed that patients having TMJ dysfunction undergoing OGS are likely to have improved signs and symptoms. Overall subjective treatment outcome shows 80% improvement and 16.4% no change and 3.6% worsening responses from subjects [7].

When coming to joint space and volume evaluation radiographically, shows no significant relation between advancement of mandible and change in volume. Remodelling may be a part of physiological adaptation of the TMJ [13]. But condyles showed statistical decrease in mean volume in follow-up, showing 33.3% of samples showing decrease in volume and 21.1% showing increase in volume.

Clinical examination showed significant increase in number of patients with TMJ pain only, TMJ pain and sounds and decrease in number of subjects with TMJ sounds only and incisal opening postoperatively.

DISCUSSION

Common symptoms of TMJ dysfunction include TMJ sounds/noises, pain, headaches, limited movement, change in occlusion, masticatory difficulty, earaches, tinnitus, vertigo, and others. Some patients, however, may be asymptomatic or have relatively innocuous clinical symptoms [2]. Common TMJ conditions that may present with smooth TMJ function (no TMJ sounds) include 1) displaced non reducing disc, 2) preclick disc displacement (early reduction without a click), 3) medial displacement of the disc, and 4) displaced disc, but with a thickened bilaminar tissue, which may provide for smooth condylar translation onto the disc on opening; this can occur in cases with idiopathic condylar resorption, long-term splint therapy, or long-term Class II orthodontic mechanics. These conditions may go undetected unless pain or dysfunction is present to alert the clinician of a possible TMJ problem during routine presurgical evaluation of orthognathic surgery patients [14].

The displacement and remodelling of condyles are commonly associated with OGS which is a part of physiological adaptation process. But, when the capacity of the joint exceeds, it may lead to condylar resorption onset. OGS may be a factor of resorption in class 2 patients and is more significant in females. Further studies with long follow-up is required to confirm the possibility [15].

We can conclude saying OGS may slightly affect mouth opening but increase in mandibular hypomobility may be due to scarring and atrophy of muscles and connective tissues. Literature agrees with development of TMJ disorders after OGS even if they were asymptomatic [3].

Panula et al. had patients who had developed new symptoms but as TMJ disorders are considered multifactorial, physical, physiological, and social factors may also cause the problem. No cases of condylar resorption were seen but with some authors it is seen with female predilection [16,17]. Westermark et al. found more patients of TMJ symptoms in retrognathic people than with people with prognathism and De Clercq et al. found more prevalence of TMJ disorders in class 2 deformity, deep bite, and low angle [6,16]. Some authors have suggested that 92% of the patients who underwent OGS were satisfied with their results [18].

The TMJs are the foundation for stable results with orthognathic surgical procedures. In the presence of healthy joints, execution of sound surgical technique, passive seating of the proximal segments and condyles in the depth of the fossa with the articular discs in a proper anatomic relationship to the condyle, provides predictable and stable postsurgical outcomes [19]. When the mandible is advanced, increased loading of the joints occurs until the TMJs, soft tissues, muscles, skeletal structures, and occlusion reach a state of equilibrium and adapt to the new position, which could take several months. Although advancement of the maxillomandibular complex in a counter clockwise direction may further increase the loading of the TMJ by stretching the associated soft tissues, it is a very stable procedure in the presence of healthy joints [20].

In patients with a pre-treatment of internal derangement, orthognathic surgery may result in a change in the condyle-disc relationship. Condyle-disc relationships and orthognathic surgery has been the subject of controversy and some research papers. It is known that disc position can change after a mandibular osteotomy [21]. This change in position may explain why some of the pain in the TMJ decreases after corrective jaw surgery. Others, however, have suggested that a change in disc position is a potential source of increased symptoms. Toll, in 2010, using MRIs found that patients with a Class II malocclusion have the highest incidence of disc displacement and this group may be most vulnerable after surgery, suggesting doing MRIs as a part of the workup.

Disc displacement also has been confirmed in other studies. Fernandez, in 1998, found 53.6% of patients diagnosed with a Class II dentofacial deformity had anteriorly displaced discs. The incidence of an internal derangement in Class I and Class III groups was much lower (10%). Others report that disc position does not change after orthognathic surgery and its implications in resolving TMDs after orthognathic surgery are not clear.

A reduction in myofascial pain is another possible effect of orthognathic surgery. During the presurgical orthodontic phases, Ellis showed that decreases occur in the range of motion and maximum voluntary bite force [10]. There is no indication that these changes are the result of physiologic alterations of the muscles of mastication and probably they are a result of the pain and discomfort of the orthodontic appliances and induced malocclusion. This may explain why there is an improvement in TMDs of muscular origin after orthodontics/orthognathic surgery. The other possible mechanism is an improvement in masticatory ability and performance, as well as fewer occlusal interferences, which possibly helps reduce the patient's TMD symptoms [15].

Peripheral factors like occlusal discrepancies and the anatomy of the bony structures of the orofacial region have been considered the primary causative factors for bruxism in the past, but we now know that they play only a small role, if any. However, some studies have shown that occlusal interferences, especially non-working interferences, CR-CO discrepancies, and molar asymmetry may worsen bruxism and have suggested that it would be useful to examine occlusal contacts in bruxing patients to eliminate probable causative or contributing occlusal factors [21]. This supports the thesis that a malocclusion may worsen bruxism and increase some TMD symptoms in patients with dentofacial deformities. After the occlusion is corrected, elimination of occlusal interferences may decrease bruxism, allowing some muscular-related symptoms to improve.

Examination

Obtaining a detailed history from patients using TMD symptoms questionnaire is important prior to physical examination. During the initial consultation, chief complaints and history of present illness including TMD related symptom location, onset of occurrence, condition, and character, alleviating or aggravating factors, and timing must be reviewed. Then, a focused physical examination is performed to identify the causes of symptoms and diagnosis. The range of motion of the mandible is measured at active and passive maximum interincisal distance as well as at the onset of pain. When TMD symptoms are present, the location and onset of the pain are further investigated. The examination for muscles of mastication involves palpation of each muscle group and observation for any pain, spasms, or fasciculation. TMJ palpation is useful for identifying intracapsular pain, joint noise, and translation. Also, TMJ loading test using tongue blade biting can be applied to evaluate intracapsular pain.

Panoramic radiograph is a good screening tool for mandibular condyles and corresponding glenoid fossa relationship. For more detailed anatomic structure evaluation, multi-slice computed tomography (CT) or cone-beam computed tomography (CBCT) can be used. CT scans including CBCT is an excellent radiographic modality to evaluate mandibular condyle morphology, anatomic position, cortical erosion, presences of cyst or tumor, and ankylosis. The gold standard imaging modality for the disc and soft tissue surrounding TMJ is magnetic resonance image (MRI), and the changes in disc position and location, morphology, and degenerative changes can be confirmed. However, MRI alone is not sufficient to formulate a treatment plan, and other clinical findings are incorporated to make correct diagnoses and comprehensive treatment plans. MRI is not routinely performed on patients with DFD, thus clinical presentation, signs and symptoms, and standard radiographic images such as panoramic radiograph are used to make a correct diagnosis and implement further corresponding treatment modality.

Treatment of temporomandibular joint disorders

Once a correct diagnosis is made from detailed clinical data, initial treatment must be started with reversible options including patient education, medications, physical therapy, and occlusal splint therapy. Minimally invasive options (eg, trigger point injections, Botox injections, arthrocentesis, or arthroscopy) are available for TMJ pain and dysfunction, and open arthroplasty can be performed as later options when indicated. Most TMD symptoms (approximately 85-90%) are treated with non-invasive, nonsurgical, and reversible interventions. Patients with intra-articular disorder who have been refractory to nonsurgical treatment over 3 to 6 months with persistent pain and limited function would require a consideration for surgical interventions.

Influence of orthognathic surgery to temporomandibular joint

Many DFD patients desire to improve stomatognathic function and esthetics, as well as TMJ symptoms. However, current literature on the relationship between OGS and TMJ complications are still debatable [22]. Some authors claim that TMJ dysfunction can be improved after OGS, yet others claim deleterious effects on TMJ can occur after OGS [23,24]. Routine OGS procedure involves surgical movement of the upper jaw via LeFort I osteotomy and lower jaw via ramus osteotomy. LeFort I osteotomy is not associated with direct trauma to TMJ or masticatory musculature, thus there are only minimal effects on TMJ dysfunction or mandibular movement. Therefore, this review article focused on mandibular surgical modalities which directly affect the mandibular range of motion, mastication, and TMJ symptom changes.

Sagittal split ramus osteotomy (SSRO) SSRO is a well-known and very commonly used surgical technique worldwide for repositioning the mandibular dental arch in both directions by advancement and setback movement of the mandibular body [25]. SSRO provides a broad medullary contact between the bony segments that ensures stable healing capability. Internal fixation of bony segments eliminates or reduces the duration of intermaxillary fixation (IMF), plus a predictable immediate postoperative occlusion is achievable. The risk of neurovascular bundle injury is higher compared to intraoral vertical ramus osteotomy (IVRO) [26], and the risk of unfavourable fracture during the split between the bony segments was reported at 0.9% [27]. The risk of complications is reduced when experienced surgeons perform the procedure. Reproducing the original condylar position is difficult, and too much pressure can be placed against the articular disc or unfavourable condylar position can be created during SSRO. These conditions can potentially result in joint noise or pain and can worsen any pre-existing TMD symptoms. In association with mandibular setback surgery using SSRO, Ueki et al. [28] reported TMJ symptom relief in 66.7% of patients after SSRO, and Hu J et al. [29] reported symptom improvement in 40% of patients, yet a development of new TMJ symptom in 8% after SSRO. Kerstens et al. [30] reported 66% improvement of TMJ symptoms and 11.5% aggravation of symptoms while White et al. [31] showed 89.1% improvement, 2.7% no changes, and 8.1% aggravation in TMJ symptoms. Although a small degree of postoperative posterior or lateral displacement of condyle can be made following SSRO in class III patients, these minor changes do not create significant changes in TMJ disc position or postoperative pain.

TMJ remodelling is divided into functional and dysfunctional remodeling. Dysfunctional remodelling has a significant alteration of the joint or occlusion and can cause reduction of condylar-ramus height, mandibular setback leading to class II malocclusion. Dysfunctional remodelling is also known as condylar resorption which can be induced from systemic and local arthritis or trauma. Because a clear etiology is not present, it is categorized as idiopathic condylar resorption (ICR).

Maxillomandibular complex counter clockwise rotation via LeFort I osteotomy and SSRO can increase the mechanical loading of TMJ, and can lead to postoperative relapse. Patients with systemic diseases such as rheumatoid arthritis, scleroderma, systemic lupus erythematosus, and other vascular collagenous diseases are known as high risk factors for condylar resorption [32]. Predisposing factors for ICR are the presence of TMJ dysfunction, young woman, high mandibular plane angle, and posteriorly inclined condylar neck [33].

A large amount of mandibular advancement via SSRO should be avoided to prevent condylar resorption occurring from the tension of stretched surrounding soft-tissue components. Internal fixation with monocortical miniplates and screws (1.5- 8.9%) showed more favorably response to condylar resorption than using bicortical screws (2–50.3%) during SSRO [34]. This is likely due to a torques being created on condyles from the proximal segment displacement during bicortical fixation. The use of computer-aided design/computer-aided manufacturing-made condyle positioning jig has been suggested to minimize a significant condylar displacement or torque [35].

The postoperative relapse of open bite from condylar resorption usually occurs between 6 months to 3 years, thus a regular follow up is important to intervene early in the process. Anti-inflammatory medication, tumor necrosis factor inhibitor, or matrix metalloproteinase inhibitor as pharmacotherapy, or a utilization of occlusal splints to reduce the joint loading can help prevent resorption. A total joint replacement option is also available if further active resorption process continues.

Zimmer et al. [36] reported that two-jaw surgery (maxillary advancement and mandibular setback surgery) had no influence on mandibular mobility compared to a single-jaw surgery. Mandibular hypomobility is a common condition after mandibular advancement via SSRO especially with a prolonged IMF duration, degenerative changes during the periods of IMF, masticatory muscle unused atrophy, and decrease in muscle energy reserves due to immobilization. Atrophy of human skeletal muscles and a decrease in strength and muscle energy reserves have also been associated with immobilization. Aragon et al. recommended a sound postoperative rehabilitation program following orthognathic procedures to prevent hypomobility [37].

Intraoral vertical ramus osteotomy (IVRO) is one of mandibular osteotomy techniques commonly used for mandibular setback procedure. A vertical osteotomy is made posterior to lingula, and proximal segment is placed lateral to distal segment without internal rigid fixation. It is a relatively simple procedure and surgical time is much reduced compared to SSRO. Also, the risk of inferior alveolar nerve damage and neurologic deficit is lower. Less than 1 mm of posterior relapse can occur after mandibular setback via IVRO, but the risk of further relapse is low, and overcorrection is not commonly indicated. Increased transverse facial width from laterally positioned proximal segment is less than 1% due to continuing remodelling process [38].

A drawback of IVRO is the requirement of IMF since internal rigid fixation is not performed, and some clinicians recommend more than 4 weeks of IMF postoperatively. However, active physical therapy with less than 2 weeks of IMF demonstrated a stable occlusion and good bone healing, some study reported just one day of IMF followed by early jaw exercise being sufficient [39]. When initial bite is unstable, an active physical therapy with close follow-ups, and re-IMF protocol is used to obtain improved occlusion, and 88% of patients achieve a stable occlusion after IVRO within 10 days of active physical therapy and Maximum mouth opening (MMO) more than 30 mm [40].

IVRO requires a wide dissection of lateral aspect of ramus and medial aspect of proximal segment for muscle detachment. Freed proximal segment initially moves anterio-inferiorly and reduces the pressures on articular disc by physiologic equilibrium position and better condyle-disc relation. Anterio-inferiorly moved condyle eventually returns back to its original position over time postoperatively.

Improvement of joint sound, pain, and other TMJ symptoms after IVRO is likely due to resting of TMJ and surrounding musculature during IMF period as well as the condylotomy effects from anterio-inferior movement of condyle. IVRO was reported to have 50-100% improvement of TMJ symptoms, and Jung et al. [41] reported 70.8% ~ 94.3% improvement of joint sounds and 89.4% improvement of TMJ pain after IVRO. Ueki et al. [28] reported TMJ symptom improvement in class III patients 88% after IVRO and 66.7% after SSRO, but MRI study showed 50% of improvement of anteriorly displaced disc after IVRO and no improvement after SSRO.

Horizontal condylar axis tends to be medially rotated when TMJ disc displacement or degenerative joint disease is present, and some authors suggested that medially rotated condyle is the etiological factor for TMD. From this point of view, lateral rotation of the condyle after IVRO is very effective improving TMJ symptoms. Choi et al. [42] evaluated 200 patients' postoperative changes in proximal segment and condyles on the transverse plane after IVRO using submentovertex cephalogram. This study reported 15.05 (SD: 8.97)° of postoperative lateral rotation of condyles which slowly returned towards the original position, yet 4.53 (SD: 6.03)° of lateral rotation remained at 1 year. This study included only class III malocclusion patients with low TMD prevalence, and some patients were without known TMD. The condyles remained in a laterally rotated position in all patients including the ones without known prior TMDs. Thus, laterally rotated condyles from IVRO improving TMD cannot be concluded from this study.

Condylar sagging in lateral or anterio-inferior direction can occur after IVRO. Condylar sagging can be avoided with careful dissection during the ramus osteotomy and not violating condylar capsules. In fact, the changes in the intercondylar distance on the transverse plane after IVRO is not significant. Excessive interference between the segments can induce sagging, thus reduction of bony interference or using a modified osteotomy design should be considered.

To prevent post OGS mandibular hypomobility, implementation of a sound postoperative rehabilitation program is very important. The incidence of mandibular hypomobility after IVRO is very low and recovery of MMO is known to be 90-98% of pre-operative opening. Aragon et al. [37] showed 90% of recovery in 13 patients, Storum et al. [43] showed 98% of recovery on 24 patients, Boyd et al. [44] showed 98% of recovery in 9 patients, and Jung et al. [40] reported 91.3% of recovery in 187 patients within 6 month and 95.7% recovery at 24 months after the procedure. Patients with MMO less than 40 mm showed 112.5 to 123.2% recovery after IVRO procedure.

CONCLUSION

In health care, patient satisfaction is an important factor. The result of this study confirms that the OGS significantly reduces thew prevalence of TMJ disorders, the decrease in symptoms can be explained by improved occlusal relation reduced emotional stress after surgical correction. But for Onizawa et al. these changes are because on muscles of mastication by surgery rather than correction of malocclusion. Phakala et al. stated that patients with myogenic origin got more relief than those with atherogenic components of TMJ disorders. Harper showed only 17% of patients developed normal condylar pathway tracings with presurgical TMJ symptoms.

By these results our study supports that TMJ internal derangement can be improved with routine OGS. But TMJ disorders must be closely evaluated prior to Orthognathic surgery and patient should be informed with possibility of onset of new minor TMJ symptoms.

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