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Temporomandibular disorders after orthodontic treatment and orthognathic surgery (A Case Report)

Fernando and Ricca Chairunnisa

Abstract
Temporomandibular disorders (TMDs) are musculoskeletal disorders affecting the temporomandibular joint (TMJ), the masticatory muscles and they are the most common cause of orofacial somatic non-odontogenic pain. The orthognathic surgery is a surgery procedure which is done to improved facial profile and a correction of skeletal malocclusion and asymmetry. Then temporomandibular symptoms may be developed after orthognatic surgery are caused by the change in fossa-condyle-disk structure and the adaptation of the neuromuscular system. The aim of this paper is to explain the occurrence of TMD in patients who have undergone conventional orthodontic treatment and follow by orthognathic surgery and the treatment option. A young woman presented to Prosthodontics clinic of RSGMP FKG-USU with a chief complaint of severe pain in TMJ area and sound in the joint. The patient has history of interlocking joint if she opened her mouth too wide once after finishing her orthodontics treatment and orthognathic surgery. Before the treatments, the patient did not have complaint in the TMJ. The plan for treating the patient complaint is making a reposition splint. The definitive treatment for the patient is orthodontic treatment. It can be concluded that patients who have undergone orthognathics surgery may have TMD signs and symptoms TMD.

Keywords: temporomandibular disorders, orthodontic treatment, orthognathic surgery

Introduction
Temporomandibular joint as the name suggest is the articulation of the lower jaw (condyle of the mandible) with the cranium (inferior surface of the squamous portion of the temporal bone). It is one of the most complex joints in the body. TMJ is formed by mandibular condyle fitting into the mandibular fossa of the temporal bone. Separating these two bones form direct articulation is the articular disc. The carniomandibular articulation is a complex synovial system composed of temporomandibular together with their articular ligaments and masticatory muscles [1].

According to American Academy of Orofacial Pain (AAOP), temporomandibular disorder is a collective term embracing a number of clinical problems that involve the masticatory musculature, temporomandibular joint and associated structures or both. In recent update, the American Academy of Orofacial Pain divided TMD in two broad catagories: TMJ disorders and masticatory muscle disorders. Meanwhile, according to American Association of Dental Research (AADR) recognized that temporomandibular disorders (TMD) encompass a group of musculoskeletal and neuromuscular conditions that involve the temporomandibular joints, the masticatory muscle and all associated tissues. TMD is considered a muscolo-skeletal disorder. It is the most prevalent clinical entity affecting the masticatory apparatus, and is the main cause of pain of non dental origin in the oro-facial region [2-6].

The etiology of TMD remain mired in controversy. It is generally agreed that the etiology of symptoms of TMD is multifactorial. That is several different factors acting alone, or in varying combinations may be responsible. Factors that is included are parafunctional habits (nocturnal bruxing, tooth clenching, lip or cheek bitting) emotional distress, acute trauma to the jaw, trauma from hyperextension (dental procedures, oral intubations for general anesthesia, yawning), instability of maxillomandibular relationship (occlusal interferences, crossbite, class II or III malocclusions, anterior open bite, excessive overjet), laxity of the joint, comorbidity of other rheumatic or musculoskeletal disorders, or general health and an unhealthy lifestyle. Symptoms and signs are also affected by ethnicity, social class and psychological status.

These factors may predispose, initiate or perpetuate temporomandibular disorders [1-8].

According to American Academy of Orofacial Pain, TMD has been divided into two broad categories, TMJ disorders and masticatory muscle disorders, which are listed below: [3]

I. TMJ disorders.

1. Joint pain: arthralgia (synovitis, capsulitis and retrodiscitis)
2. Joint disorders:

a. Disc-condyle complex disorders (disc displacement with reduction, disc displacement without reduction)
b. Hypomobility disorders (intra-articular fibrous adhesions, ankylois)
c. Hypermobility disorders (subluxation, luxation)

3. Joint diseases:

a. Osteoarthritis also known as degenerative joint disease, condylysis, osteochondritis dissecans, osteonecrosis
b. Systemic arthritides such as rheumatoid arthritis, idiopathic juvenile arthritis, spondyloarthropathies, psoriatic arthritis, infections arthritis, Reiter syndrome and crystal induced disease.
c. Neoplasmas
d. Fractures (Open and closed condylar and subcondylar)

II. Masticatory muscle disorders

1. Muscle pain limited to orofacial region (myalgia, myofascial pain, tendonitis, myositis, spasm)
2. Muscle pain due to systemic/central disorders (centrally mediated myalgia, fibromyalgia)
3. Movement disorders (dyskinesia, dystonia)
4. Other muscle disorders (contracture, hypertrophy, neoplasm)

Over the last years, the relationship between orthodontics and TMD is increasingly gained attention. The literature still does not reach consensus but some studies verified that occlusal factors play some in TMD development. Studies on the consequences of orthodontic treatment on TMD have shown that such treatment neither increases nor decreases the risk of developing TMD later in life, and some recent studies have found less prevalent TMD signs and symptoms in subjects who have received orthodontic treatment, compared with orthodontically untreated subjects. While other studies, stated that condylar resoprtion is one of the iatrogenic examples of TMDs development possibly related to orthodontic treatment. Orthodontic forces can often cause undesired reactions of partitioning within the alveolar bone [4, 6, 7].

Patients with dentofacial deformity (DFD) require an orthognathic surgery (OGS) for an improved facial profile and correction of skeletal malocclusion and asymmetry. The motivating factors for patients undergoing OGS are to improve mastication, speech, and swallowing functions as well as facial esthetic and psychosocial factors. The mandibular condyle is one of the anatomic structures that consist of TMJ and the position of condyles in relation to temporal bone can be altered via various movement during OGS. Thus, OGS can affect both functional and esthetic components including mastication, pronounciation and TMJ functions. The positional changes of mandible, maxilla or both jaws during OGS, can effect TMJ, masticatory musculature, its surrounding soft tissue, and TMD symptoms. Therefore, maxillofacial surgeons must carefully evaluate patients for presence of any TMJ symptoms preoperatively, and formulate treatment plans accordingly to prevent worsening of TMD symptoms. The temporomandibular symptoms may be developed after orthognathic surgery are caused by the change in fossa-condyle-disk structure and the adaptation of the neuromuscular system, and the change in fossa-condyle-disk is directly caused by the lateral pterygoid when semi-rigid is applied. The direct change in condylar position can take place during surgical operation such as the application of rigid fixation. The improvement of clinical symptoms after orthognathic surgery can be explained by the occlusal stability after surgery and the reduction of emotional stress, whereas the occurrence of TMD after orthognathic surgery can be attributed to the condylar pressure due to inadequate fixation of proximal segment and change in the internal structure of the joint itself [8, 9].

Objective

The aim of this paper is to explain the occurrence of TMD in patients who have undergone conventional orthodontic treatment followed by orthognathic surgery and the treatment option.

Case report

Patient, female, 27 years old, visited our Prosthodontic Clinic at RSGMP FKG-USU with chief complain clicking at TMJ joint when yawning, open her mouth too wide, and close her mouth since 7 years ago. She had undergone orthodontic treatment from 2003-2009 for treating malocclusion class III Angle and she had done orthognathic surgery (Bilateral Sagital Split Osteotomy) in 2003. Patient stated that she didn't have any complain at her TMJ joint before she underwent orthodontic treatment and orthognathic surgery. Patient had been ever experienced locking at her TMJ joint and couldn't close her mouth. Recently, the complain came up more often when she worked as workshop committee. She also has bad habit. She always sleep facing on right side only.

Fig 1: Patient Profile (Side and Front)

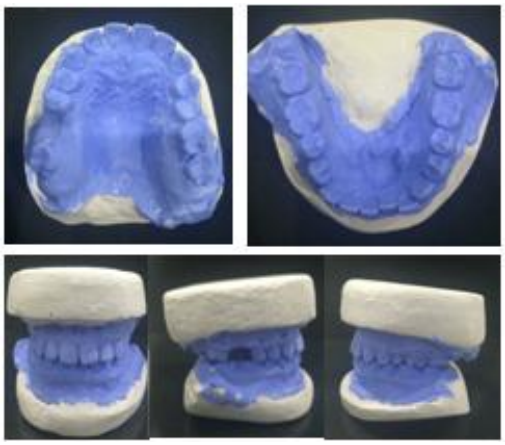

Fig 2: Diagnostic Cast

From clinical examination found that she had extracted her 16

teeth 1 year ago, her 41 is linguoversi, her 42 is labioversi, and she has filling on 17, 15, 21, 22, 26, 37, 36, 46 and 47. She also use 1 unit saddle of flexi denture. Then, the TMJ joint and its surrounding muscular were examined. From the examination, the results are below:

Examination	Region	
	Right	Left
M. Temporalis	Ant, med, Post: 0	Ant : 0; med : 0; Post : 0
Tendon temporalis	0	0
M. Masseter	1	0
Cervical posterior neck	2	0
Sternocleidomastoideus	2	0
Trapezius	2	0
Protrusive movement	1.5 mm	
Maximum Opening mouth without pain (mm)	33.5 mm	
Maximum opening mouth	47 mm	
Lateral movement	9 mm	7 mm
TMJ pain (Lateral Pole)	-	-
TMJ pain (Posterior Pole)	+	-
TMJ sound	clicking	-
headaches	-	-
Tinitus	-	-
occlusion	Normal Overjet normal	
Mandible Mid Line when maximum opening mouth	Deflection to the right when open mouth	

Fig 3: M.Temporal Examination

Fig 4: M.Masseter Examination

Fig 5: M.Sternocleidomastoideus Examination

Fig 6: M.Trapezius Examination

Fig 7: M. Pterygoid Examination

Fig 8: Maximum mouth opening without pain

Fig 9: Protrusive movement

Fig 10: Maximum mouth opening with pain

Fig 11: Lateral Movement (Left)

Fig 12: Midline Examination

Fig 13: Lateral Movement (Right)

Fig 14: TMJ Sound Examination

Fig 15: Lateral Pole Examination

Fig 16: Posterior Pole Examination

From the occlusion analysis, there were traumatic occlusion found on the flexible denture and the filling teeth 17, 36 and 37 (Fig 17 and 18). The radiographic examination on close position showed that the condyle was in the fossa and the condyle and fossa gap of the right side are close so there is possibility that the disk had moved to anterior. The radiographic examination on open position showed that the condyle of the right side was behind the eminence and the condyle of the left side was in front of the eminence.

Fig 17: Upper Jaw Occlusal Analysis

Fig 18: Lower Jaw Occlusal Analysis

Fig 19: TMJ Radiographic Examination (Close Mouth)

Fig 20: TMJ Radiographic Examination (Open Mouth)

From the data collected, the diagnose for the patient using RCD/TMD is disc dislocation without reduction followed by myofascial pain syndrome (MPS) et causa traumatic occlusion, orthognathic surgery and bad habit.

The treatment plan for the patient divided by 2 phase. The first phase consist of symptomatic therapy which are, fix the bad habit, physiotherapy (compress with warm water when the complaint come-up), psychologic (motivation for relieving the work stress) and fabrication of reposition occlusal splint. Meanwhile, for the second phase, the patient must undergo orthodontic treatment again to fix the tilting teeth and occlusal adjustment on remaining teeth and prosthesis.

First step for occlusal splint fabrication was making impression. After that, the bite was recorded for repositioning splint (Fig 21). The patient was asked to protrude her mandible into edge-to-edge position as the freeway space gap. Then, the cast was surveyed to obtain the wax-up area. After that, the cast was set into the semi-adjustable articulator (Fig 22 and 23). Then, the cast was waxed-up (Fig 24 and 25). Wax-up was done on the mandible cast because of the patient wore prosthesis on the maxilla. The wax-up must be done according to survey result and did not exceed the gingival margin to avoid irritation. And then, the splint was polymerized into the clear acrylic resin. Then, the splint was inserted to the patient (Fig 26). She had to come back to the clinic 1 week after the insertion to follow-up the splint and 2 weeks after the first control. At the follow-up, check the TMJ related muscles, spasm and pain, the maximum opening mouth, deflection of the jaw, tinnitus, clicking and the the splint itself.

One week after insertion, the patient come back to control her splint. She said that the complaints have decreased. She was able to chew soft food without pain, the clicking sound had gone. The muscle spasm and pain also had decreased. Then, the splint thickness was reduced by 0.5 mm (Fig 27). Two weeks after first follow-up, the patient came back again to follow-up again. She was able to chew hard food with a little pain. There was a little muscle spasm and pain. And the splint thickness was reduced by 0.5 mm again (Fig 28). Then the patient was asked to come back again two weeks later until the complaint is gone.

Fig 21: Bite Registration with Facebow

Fig 22: Transfer cast to articulator semi-adjustable

Fig 23: Mounted Cast

Fig 24: Final Wax-up (occlusal view)

Fig 25: Final Wax-up (anterior view)

Fig 26: Splint Insertion **Fig 27:** Follow-up I

Fig 28: Follow-up II

Discussion

TMD has a multifactorial etiology because of it is a complex structure affected by a variety of variables. The role of orthodontics in the development of temporomandibular joint disorder has been speculated for many years [2, 10]. Henrikson T *et al* in 2000 concluded from their study that orthodontic treatment either with or without extractions did not increase the prevalence or worsen pre-treatment TMD. TMD flucatuated substantially over time with no predictable pattern. The type of occlusion may play a role as a contributing factor for the development of TMD and so Mohlin B *et al* in 2004 and Marfarlane TC *et al* in 2009 stated that orthodontic treatment neither causes nor prevents TMD. Female and TMD in adolesecence were the only predictors of TMD in young adulthood [2].

Meanwhile, Abrahamsson *et al* in 2013 investigated the alteration of TMD after correction of dentofacial deformities by orthodontic treatment in conjuction with orthognathic surgery and compared the frequency of TMD in patients with dentofacial deformities with age and gender matched control group found that patients with dentofacial deformities, corrected by orthodontic treatment in conjuction with orthognathic surgery, seem to have a positive treatment outcome in respect of TMD pain [11].

Questions often arise regarding the appropriate timing for orthognathic surgery in growing patients and the possible effects of such surgery on subsequent facial growth. Approximately 98% of facial growth is usually complete in

girls by age 15 and in boys by approximately age 17 or 18 [12]. Patient underwent orthognathic surgery at 14 years old when mandible growth and bone remodeling has not been completed so that there is a possibility changing in TMJ structure that cause TMD.

Conclusion

It can be that orthodonthic treatment can cause TMD if the treatment is incorrect. Although the literature stated contrary, but, nowadays there are so many patients complain about TMJ problem after they finish their orthodontic treatment. Orthognathic surgery usually cure TMD but in this case, the orthognathic surgery is performed for esthethic purpose. And the patient underwent the surgery too early whereas the surgery can be performed after the bone growth stop and it cause the TMD for the patient.

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