

Case Report

The importance of masticatory functional analysis in the diagnostic finding and treatment planning for prosthodontic rehabilitation

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ABSTRACT

Background: The masticatory system as a biologic system is subjected to harmful influences of varying severity. Almost half of routine patients requesting prosthodontic treatment indicated at least one sign or symptom of temporomandibular disorders. Analysis of the masticatory system often neglected by dentist. Untreated temporomandibular disorders may significantly implicated in the perpetuation of the disorder and may interfere with routine prosthodontic clinical procedures. It would be resulted unsuccessful long term goal of prosthodontic rehabilitation because of the uncompleted diagnoses and treatment plan. **Purpose:** The purpose of this case report was to give the information of the importance of masticatory functional analysis in the diagnostic finding for treatment planning in the prosthodontic rehabilitation. **Case:** A 45 year - old male patient, partial dentate with reduced chewing efficiency, mild pain in right preauricular region in function, left click in opening mouth, severe attrition on all anterior lower teeth with vertical dimension of occlusion decreased due to loss of posterior support. He wanted to make a new denture. **Case management:** Record and analyze of active and passive mandibular movement, opening pathway, muscle and temporomandibular joints palpation, load testing, and vertical dimension of occlusion with manual functional analysis (MFA), occlusal condition and radiographic examination. Treatment plan was formulated into 3 phases: stabilization of the masticatory system, definitive treatment and periodical control. The result of this treatment excellent for 1 year evaluation after permanent cementation. **Conclusion:** Masticatory functional analysis is very important and must be done in the diagnosis finding for treatment planning in every case of prosthodontic rehabilitation.

Key words: Severe attrition, masticatory functional analysis, prosthodontic rehabilitation

ABSTRAK

Latar belakang: Sistem pengunyahan sebagai sistem biologis sewaktu-waktu dapat terjadi gangguan dengan berbagai derajat keparahan. Hampir setengah dari jumlah pasien yang memerlukan perawatan prostodontik minimal menunjukkan satu tanda atau keluhan dari gangguan temporomandibular. Analisis fungsional sistem pengunyahan masih sering dilupakan oleh dokter gigi. Gangguan temporomandibular yang tidak dirawat akan terus ada dan mungkin dapat mengganggu prosedur klinis perawatan prostodontia. Hal tersebut akan menyebabkan keberhasilan klinis jangka panjang perawatan prostodontia tidak dapat tercapai karena diagnosis dan rencana perawatan yang kurang lengkap. **Tujuan:** Tujuan dari laporan kasus ini adalah untuk memberikan informasi tentang pentingnya analisis fungsional sistem pengunyahan untuk menegakkan diagnosis dan rencana perawatan pada perawatan prostodontia. **Kasus:** Pasien laki-laki usia 45 tahun, bergigi sebagian merasa sulit untuk mengunyah makanan, nyeri ringan di daerah depan telinga kanan saat fungsi, keletuk sendi kiri saat membuka mulut, atrisi pada seluruh gigi depan rahang bawah disertai penurunan dimensi vertikal oklusi akibat kehilangan dukungan gigi belakang. Dia ingin membuat gigi tiruan yang baru. **Tatalaksana kasus:** Mencatat dan menganalisis pergerakan aktif dan pasif rahang bawah, arah pergerakan rahang bawah saat membuka mulut, palpasi otot-otot pengunyahan dan sendi temporomandibula, uji beban, dimensi vertikal oklusi dengan metode analisis fungsional secara manual, keadaan oklusal dan radiologis. Rencana perawatan dibagi menjadi 3 tahap berupa stabilisasi sistem pengunyahan, perawatan tetap dan kontrol secara periodik. Hasil perawatan menunjukkan keberhasilan klinis yang baik setelah dilakukan evaluasi selama 1 tahun

setelah penyemenan tetap. **Kesimpulan:** Analisis fungsional sistem pengunyahan sangat penting dan harus dilakukan untuk menegakkan diagnosis dan rencana perawatan pada setiap perawatan prostodonsia.

Kata kunci: Atrisi berat, analisis fungsi pengunyahan, perawatan prostodonsia

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INTRODUCTION

Masticatory system is the organs and structures primarily functioning in mastication.¹ It is an extremely complex and interrelated system of muscles, bones, ligaments, teeth and nerves² and a dynamic orthopedic system.³ The masticatory system as a biological system is subjected to harmful influences of varying severity.⁴

The temporomandibular joints (TMJs) is irrevocably connected to the rest of the masticatory system and the teeth. All forces that are applied to the masticatory system are also applied to the TMJs as well.³ Some studies and references showed that lost of posterior teeth, inadequate molar support and subtle occlusal interferences are likely to be the response of the neuromuscular system to hold the mandible in a comfortable position and impairment of masticatory function.⁵⁻⁹ This condition known as orthopedic instability and can cause to develop temporomandibular disorders (TMDs)^{2,10} and interfere with routine prosthodontic clinical procedures.³ Therefore appropriate methods for analyzing masticatory function are needed.

TMDs can be subdivided into muscular and articular categories.^{2,10} The strong relationship between muscular and articular disorders makes accurate diagnosis difficult. It must be determine whether muscle incoordination activated the disc derangement or vice versa, because their treatment is completely different.²

The dental treatment's long term goal in prosthodontic rehabilitation is to preserve the health of the patient's masticatory system.¹⁰ Therefore, programmed diagnosis and treatment is the key.⁸ In diagnostic findings, screening for a history and systematic analysis of the masticatory system is a wise precaution and can determine whether a more comprehensive evaluation is necessary.¹¹

It is important for the dentist to know what a stable, maintainably healthy masticatory system. In a complete analysis, each part of the system should be analyzed and determining the pathological condition is the main purpose of clinical diagnostic and treatment planning.^{8,10,12} For adequate diagnosis and treatment plan, a paradigm shift is necessary to change from a mechanical era, where treatment is designed to fix problem caused by neglect, to a biologically based discipline, where the dentist assess an individual patient's susceptibility or risk to disease progression. The principle is a diagnostically driven, systematic analysis of the individual patient's periodontal, biomechanical, functional and dentofacial risk level should be the driving force behind treatment.^{8,13,14}

To develop the functional stability necessary for success of treatment, the dentist must analyze the masticatory function. It is important to observation masticatory function or functional analysis may disclose uncoordinated movements that may indicate biomechanical problems^{4,11} and will determine individual patient's treatment plan.⁸ For this reason, a valid and reliable examination method is needed. One of the methods is manual functional analysis (MFA).^{2,4,13}

Functional analysis is a method for evaluating symptoms in the TMJs and muscles jaw movement. It serves further to help recognize the necessity for additional therapeutic measures and should protect both the patient and the dentist from failure.⁴ Recording the functional analysis enables the dentists suggestive of certain disorders or improvement.¹⁰ MFA is a functional analysis using manual palpation, a millimeter ruler and a stethoscope execute by a trained examiner.^{4,13}

The MFA was based active mouth opening or range of motion (ROM) consist of maximum mouth opening, protrusive, lateral movement and overlap of the central incisors, opening pathway, and some cases these are complemented by passive mouth opening (end feel), then muscles and TMJs palpation, TMJs auscultation, load testing and occlusal evaluation. A decrease ROM, deflection or deviation in opening pathway, pain in load testing and palpation, and TMJs noise suggestive of certain disorders.^{2,4-5,10,15-17}

For medical and legal reasons, a masticatory functional analysis should be a routine that dentist perform for all new patients before any definitive prosthodontic treatment should be deferred until the TMDs has been properly managed.^{4,17} For this reason, masticatory functional analysis must be reliable and valid to provide the right diagnosis and treatment plan.¹³

Dentist should realize that almost half of routine patients requesting prosthodontic treatment may clinically indicate at least one sign or symptom of TMDs.¹³ Unfortunately, masticatory functional analysis is often neglected by dentist. In fact, a precise and satisfactory prosthetic rehabilitation can only be made for a patient who has a stable masticatory system. The presence of TMDs and if not treated properly, could be implicated in the perpetuation of the disorder and may interfere with routine prosthodontic clinical procedures. This conditions would increase the awareness and indicate modifications of diagnosis and treatment plan or at least precautionary measures during the course of the prosthodontic therapy.^{6,18}



Figure 1. (A) Maximum intercuspation showed deep overbite, (B, C) with loss of posterior support.

The purpose of this case report is to give the information of the importance of masticatory functional analysis in the diagnostic finding and treatment planning in prosthodontic treatment.

CASE

A patient 45 years old man presented to the prosthodontic specialist clinic at Airlangga University Dental Hospital with main complaint about reduced chewing efficiency and had a dull pain in right preauricular region. He wanted to make a new denture. His previous denture was a removable posterior mandibular bare root overdenture and since three month ago he had never used the denture because of the discomfort. The pain began after trying to bite on posterior teeth since a week ago. This pain was aggravated by trying to bite on his right posterior teeth. He had a left click without pain every time he opened the mouth. There was no systemic diseases and patients was in good health.

MFA revealed a limitation of maximum mouth opening (32 mm) (normal value 40-50 mm)¹² accompanied by a mandibular deflection to the left (3 mm), assisted mouth opening or passive movement 1 mm longer than maximum mouth opening (end feel soft), right lateral movement 6 mm (normal value 7-15 mm),¹² left lateral movement 7 mm (normal value 7-15 mm),¹² protrusive movement 7 mm (normal value 7-15 mm).¹² Palpation of his masticatory muscles identified that pain was limited to right medial pterygoid and no pain in rest position. Palpation of both lateral TMJs areas were not tender and confirmed a click during mandibular opening in the left side. Load testing was no pain. Vertical dimension of occlusion (VDO) was assessed by phonetic evaluation (closest speaking distance) 4 mm (normal value 1-2 mm),^{12,19} interocclusal rest space 6 mm (normal value 2-4 mm),¹⁹ and inter cemento-enamel junction 14 mm (normal value 18-20 mm).^{8,20,21}

Intra oral examination confirmed overbite was 6 mm (normal value 3-5 mm),² overjet was 5 mm (normal value 3-5 mm),² wear facets on all anterior lower teeth, and loss of posterior support because of decapitated teeth with glass ionomer cement filling as abutment teeth for overdenture in teeth 35, 37, 38, 44, 45, 46, and 47 (Figure 1). Metal ceramic fixed partial dentures in all maxillary teeth. None of

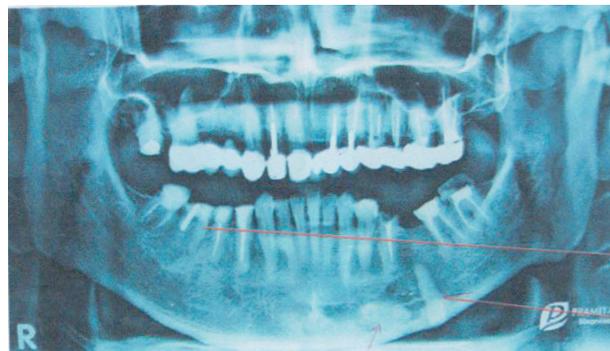


Figure 2. Panoramic radiograph showed decapitated lower posterior teeth with good endodontic treatment except tooth no. 46.

the teeth were mobile, and there was no significant gingival recession and/or furcation involvement.

Panoramic radiograph evaluation confirmed missing teeth in 18, 28, 36, and 48; proper root canal treatment in 12, 17, 22, 23, 24, 25, 26, 27, 35, 37, 38, 44, 45, 46, 47, and improper root canal treatment in 46; supernumerary teeth in left mandibular in 35 and 36 region with horizontal and vertical position (Figure 2).

On the basis of history, clinical and radiographic examination, the patient was diagnosed with local muscle soreness, anterior disk displacement with reduction, deep bite with severe attrition and loss of VDO, edentulous ridge on 18, 28, 36 and 48, post root canal treatment in 12, 17, 22, 23, 24, 25, 26, 27, 35, 37, 38, 44, 45, 46, and 47, and supernumerary teeth.

On the basis of diagnosis, the treatment plan formulated and should be broken down into 3 phases. Phase 1 treatment should be for the removal of disease, the stabilization of the joint, corresponding musculature and establishing the correct VDO; phase 2 definitive treatment; and phase 3 were maintenance of prosthesis and follow-up.

CASE MANAGEMENT

This case management begins with analyzing the masticatory function with MFA and then classified the disorders using the classification from American Academy

of Orofacial Pain (AAOP). The examination started with measuring the active and passive mandibular movement, opening pathway, muscle and TMJs palpation, measure the VDO, load testing, and occlusal evaluation.

The patient was asked to lie back in the dental chair, relax his mandible with it slightly open, and close his teeth together slowly. Measuring the active mandibular movement by asking the patient to open as wide as he can then measuring maximum mouth opening from incisal edge to incisal edge. Measuring the overlap of the central incisors by asking the patient to close into maximum intercuspation (MI), marked on the facial surface of the mandibular incisor against the maxillary central incisor's incisal edge, then asking the patient to open and observes the distance from the mandibular central incisor's incisal edge to the marked on the ruler. Measuring the lateral movement by asking the patient to close into MI and asked to move his mandible as far as possible to the right and left side then observes the distance the embrasure on the ruler.¹⁰

Measuring the passive mandibular movement (end feel) by asking the patient open the mouth as far as possible and at the end of the active movement then assist further opening and measuring from incisal edge to incisal edge. To determine the pathway of the mandible by asking the patient open the mouth as far as possible the observed the position of the midline at the end of maximum opening.¹⁰

Muscle palpation by using bilaterally palpating for extra-oral, unilaterally for intra-oral, and face the patient during palpation. Start by palpating the anterior, middle and posterior region of temporalis muscles, TMJs, masseter muscles and intraorally palpation for lateral pterygoid in the fifth digit along the lateral side of the maxillary alveolar ridge to the most position region of the vestibule, and then medial pterygoid at the insertion site for an inferior alveolar injection and press laterally. The palpation begin with light pressure and slowly increased the force until the patient's eye or facial expression convey that the patient was experiencing discomfort (Figure 3). Palpate the TMJs noise by placing the finger's palmar surface over the TMJs



Figure 3. Muscle palpation pain in right medial pterygoid with patient's eye express discomfort.



Figure 4. Measuring the VDO using phonetic evaluation by spoken "S" sound.

as the patient opens, closes, and moves through lateral and protrusive excursions.¹⁰

Measuring the VDO using phonetic evaluation by spoken "S" sound and measuring the distance maximal closure line to the "S" sound line (Figure 4);^{12,19} then by using interocclusal rest space measured between nose tip and chin tip;¹⁹ and inter cemento enamel junction measured between cemento enamel junction anterior mandibular tooth with upper tooth.^{8,20,21}

Verifying healthy condyles using load testing by bilateral manipulation. Start with reclined the patient all the way back, stabilized the head, lifted the patient's chin again to slightly stretch the neck, position the four fingers on the lower border of the mandible and the thumbs in the notch above the symphysis, ask the patient to hinge open and close.¹²

In phase 1 treatment, the first step was to treat the TMDs symptom, loss of VDO, and stabilized the TMJs using hard stabilization splint with smooth flat plane. This splint was made by verified centric relation (CR) bite record with bilateral manipulation then mounting the cast in a semiadjustable articulator with a face bow transfer. The pain was opened 2 mm to separate all posterior teeth and the coverage area was then waxed up. Acrylic processing and insert the splint to the upper arch then observe the occlusal contact (Figure 5). The protrusive and lateral movement



Figure 5. Maxillary acrylic splint to an entire occlusal surface: articulating paper marks of centric contacts on an adjusted splint.

Table 1. The results of MFA after insertion stabilization splint

MFA	Before treatment (mm)	1 day (mm)	1 week (mm)	2 week (mm)	1 month (mm)
Maximum mouth opening	32	33	35	37	37
Right lateral	6	7	7	8	8
Left lateral	7	7	8	8	8
Protrusive	7	7	7	7	7
Deflection	3	2	0	0	0
Muscle palpation	3	2	0	0	0
TMJ palpation	0	0	0	0	0
TMJ noise	+	±	±	±	±
Load testing	0	0	0	0	0

**Figure 6.** Patient occluding on acrylic splint in the neutral position.**Figure 7.** CR bite record used silicone material and anterior index at the selected VDO.

provided 0.5 mm posterior disclusion (Figure 6). This splint wears 24 hours a day except to eat for 1 month and observe the result (Table 1).

The second step was to make a transitional denture with the reorganized approach and designed using mutually protected occlusion (MPO). This denture verified by CR bite record with anterior index (Figure 7), then mounting the cast in a semiadjustable articulator. The incisal guidance pin was opened 3 mm for the new VDO.

**Figure 8.** Correct shape and incisal edge position diagnostic wax-up.**Figure 9.** Lower anterior teeth are prepared for transitional denture with putty matrix as a guide.

The perfect anterior guidance was formed from the diagnostic wax-up made in articulated model. The process of customizing this anterior guidance is designed the shape and locate the correct incisal edge position by diagnostic wax-up (Figure 8). The leading edge of each lower anterior tooth should be formed by a definite labio-incisal line angle contour. Then analyzed in CR and move the articulator slightly forward and lateral to achieve a solid stop and posterior disclusion about 0.5 mm.

After finishing the diagnostic wax-up, a putty matrix formed from the diagnostic wax-up. This matrix was use for construction the transitional denture in autopolymerizing resin after the teeth are prepared, as a guide to prepare of the mandibular anterior teeth (Figure 9), and to communicate



Figure 10. Lower transitional denture are placed with 17 mm inter cemento enamel junction.

with the dental technician about the precise incisal edge position and contours of line angle.

This transitional denture was used as a guide for the definitive treatment (Figure 10). The transitional denture was used for 1 month to adapt the patient to the new VDO and observe the masticatory functional (Table 2).

Phase 2 treatment was not started until the transitional denture was approved. The first step of this treatment should be made the anterior restoration with perfect anterior guidance formed from the diagnostic wax-up and try-in for 1 week. The next step was to make the posterior restoration and the anterior restoration should not be cemented until all functional excursions have been verified against the upper teeth, try-in for 1 week and observed the masticatory function (Table 3), then cemented the definitive restoration (Figure 11).

In phase 3 treatment, maintenance of prosthesis and follow-up with masticatory functional analysis were done (Table 4).

DISCUSSION

Dentist should monitor not only immediate oral problems such as caries or prosthodontic needs, but also

Table 2. The result of MFA after insertion transitional denture

MFA	Before transitional denture	1 week	1 month
Maximum mouth opening	37	37	37
Right lateral	8	8	8
Left lateral	8	8	8
Protrusive	7	7	7
Deflection	0	0	0
Muscle palpation	0	0	0
TMJ palpation	0	0	0
TMJ noise	±	±	0
Load testing	0	0	0
Over bite	6	5	5
Over jet	5	3	3

disorders affecting the head, neck muscles and TMJs. So, teeth, muscles and TMJs make up an inseparable unit even throughout pathology, therapy and final outcome.²² The primary purpose of the clinical examination is to gather additional information to help confirm or rule out structures involved in a patient’s complaints and other suspected disorders that may contribute to these complaints.¹⁰

This case report used MFA for functional analysis because it is easy to learn, cost effective, reliability,

Table 3. The result of MFA in temporary cementation of definitive denture

MFA	After transitional denture	1 week
Maximum mouth opening	37	37
Right lateral	8	8
Left lateral	8	8
Protrusive	7	7
Deflection	0	0
Muscle palpation	0	0
TMJ palpation	0	0
TMJ noise	0	0
Load testing	0	0
Over bite	5	5
Over jet	3	3



Figure 11. Definitive denture copied transitional denture with 17 mm inter cemento enamel junction.

Table 4. The result of MFA after permanent cementation of definitive denture

MFA	1 week	1 year
Maximum mouth opening	37	37
Right lateral	8	8
Left lateral	8	8
Protrusive	7	7
Deflection	0	0
Muscle palpation	0	0
TMJ palpation	0	0
TMJ noise	0	0
Load testing	0	0
Over bite	5	5
Over jet	3	3

internationally accepted,^{5,13,23,24} valid and sensitivity.^{5,13,25} For classifying the disorders, this case report used the classification from AAOP because this classification is a clinically oriented taxonomic proposal that contains some referrals to the plausible pathogenesis of the different disorders.²³

The MFA procedures started with measure active and passive movement. This movement must be measured prior to palpating, because palpation can aggravate the masticatory muscles and/or TMJs, which may cause a decrease in patient's active movements. For recording maximum mouth opening, millimeter ruler was used instead of three fingers between upper and lower incisors, because the used of three fingers can be considered insufficiently accurate.²⁶ Recording the MFA enables the dentist suggestive of certain disorders or improvement.¹⁰

In this case report, MFA confirmed that there were restricted mouth opening (32 mm), painless accompanied with deflection to the left (contralateral direction from the involved muscle), end feel soft, lateral movement no deflection in and no restriction in lateral movement (right and left lateral movement in normal value), protrusive movement in normal value, no pain at rest, and muscle pain on palpation in right medial pterygoid. This condition confirmed restriction and interference of mouth opening produced by shortening of the right medial pterygoid muscle.^{2,4,5}

Medial pterygoid muscles are one of the masticatory muscles that responsible for mandibular closure and bite force. This shortening of right medial pterygoid muscle may be due to the prolonged chewing movement producing muscle fatigue, and the intercuspation of the teeth is not in harmony with the joint-ligament-muscle balance, a stressful and tiresome protective role is forced onto the muscles during mastication.^{12,13}

Muscle pain always involves the relationship between the TMJs and occlusal contact. So, the important point is to determine if the TMJs are healthy and complete seating into CR. In this case, with the use of bilateral manipulation technique confirmed painless. This indicates that the TMJs are healthy and capable complete seating into CR.¹²

Determination the VDO is a critical procedure for a totally or partially edentulous patient,¹⁹ and should not be confined to a single technique or consideration.²⁷ In this case report, the VDO assessed with phonetic evaluation (4 mm), interocclusal rest space (6 mm) and inter cementoenamel junction (14 mm) confirmed that there was a decrease VDO about 3 mm. In this case, increasing the VDO will not cause any joint changes because the patient has healthy TMJs.²⁸

In occlusal evaluation, there were severe labio-incisal wear in all anterior mandibular teeth. The possible cause of this condition may be due to the results of interference to the envelope of function, and there were no holding posterior contacts because of loss posterior teeth. The loss of posterior contacts may result in an increase anterior load which, in turn, increase the number and intensity of anterior

incisal contact.¹²

The rehabilitation of partially edentulous patients with severe tooth wear is a complex task, and more information regarding treatment protocols, prosthetic indications and treatment outcome is needed.^{12,29} For reinstating the teeth back into functional harmony with the masticatory system as a whole, the treatment plan should be broken down into 3 phases with the reorganized approach to occlusal reconstruction in definitive treatment.³⁰

This treatment would be carried out to the reorganized approach because all of the occlusal contacts are going to be changed and reconstructed. The objective of this approach is to provide an occlusion that is more ideal for the teeth, periodontal tissues and tissues of the articulatory system (TMJs and mandibular muscles).^{6,31} In occlusal reorganization, it is important therefore to know before start treatment whether a patient has an underlying TMDs, great care must be taken and try to stabilize the masticatory system. A reorganized occlusion is an occlusion in which the pattern of occlusal contact is deliberately changed or reconstructed.⁶

In the first step in phase 1 treatment, the stabilization splint with smooth flat surface was designed to offer contacts of all teeth and coordinate elevator muscles contraction. This condition always attempts to seat the condyles up into CR.¹² This stabilization splint performs a dual diagnostic and therapeutic role. As a diagnostic aid, it prevent occlusal interference, thereby relaxing the muscle and reducing tension and pain; as a therapeutic aid, it contributes to the general rearrangement of joint structures by acting on the transversal and anteroposterior planes in addition to specific vertical action from the posterior wedge.^{22,32} CR is the only condylar position that permits an interference-free occlusion and the most musculoskeletally stable position for the mandible.^{10,12} Recording of an accurate CR is critical for the most trouble-free restorative or prosthetic dentistry.¹²

After insertion the splint, record and observe the masticatory function for 1 day, 1 week, 2 week and 1 month (Table 1). In the first row, the MFA is shown for before treatment, while the others for after the use of stabilization splint. It can be seen that the value of maximal mouth opening was increased (37 mm), right lateral movement was increased to normal value (from 6 to 8), left lateral movement was increased to normal value (from 7 to 8), elimination of deflection (from 3 to 0) and elimination of pain during palpation (from 3 to 0), TMJ click was decreased (from + to ±). It is suggest that occlusal therapy of TMDs with stabilization splint was success and ready for the next step. The success of stabilization splint treatment might be the smooth flat plane contribute to occlusal stability (simultaneous contacts occur upon mandibular closure). Freedom in centric increases the occlusal comfort by allowing slight protrusive and laterotrusive tooth-guided mandibular movement along the surface of the splint. It is induced reorganization of intramuscular recruitment patterns unloads those muscle region that are

characterized by high stress concentration and overload during mastication.¹³ These effects may lead to a reduction of muscle pain, TMJ click, elimination of deflection, and increase maximal mouth opening.

In this case, 37 mm of maximum mouth opening was suggest a normal value of maximum mouth opening of this patient, because this value varies greatly and the result of measure the maximum mouth opening after 2 week using stabilization splint (37 mm) is constant until 1 year post permanent cementation. Although some references stated that minimal value of the maximum mouth opening is 40 mm, however one reference stated that some patient can function readily at 35 mm.¹⁵

The next step was to make a transitional denture. In this case, the transitional and definitive denture would be changed the VDO and determined by the distance of inter cementoenamel junction as a guide. It is the philosophy for condylar position by bioesthetics, works via a fixed numerical value based on incisal relationship that the distance of inter cementoenamel junction was 18–20 mm.^{8,20,21}

This restoration made with the reorganized approach and designed using MPO with CR bite record. This reorganized approach will be provide posterior stability and establish anterior guidance on transitional denture, the copy the anterior guidance into definitive denture. Designed using MPO, because guidance from the anterior teeth will be to protect the posterior teeth from excursive force, wear and posterior teeth supported the bite force¹² and creating a synergistic stability.²⁷ The ultimate goal of this procedures was to provide a stable occlusion to maintain the VDO during MI and to create appropriate harmonious gliding tooth contacts or anterior guidance during eccentric movements that do not cause deflection of the mandible or excessive stress to the dentition, muscles, or joints.^{33,34} In this case, CR bite record was used as the basis for reconstructing a new ICP because the patient in situations in which the existing ICP is unsatisfactory (loss of posterior support). The anterior index was used for stabilize the jaw in CR because CR registration used a fluid material (silicone).

In tooth preparation, the putty matrix was used as a guide to get a precise preparation for transitional and definitive treatment, and to communicate precise incisal edge position and contour (anterior guidance) that have been made from the diagnostic wax-up to the technician.¹² It is then copied into the definitive restoration eliminating all guesswork. This guesswork could be destroyed the anterior guidance that have been formed in the articulated model and failure of occlusal treatment causing damage of the masticatory system.

After insertion of transitional denture, record and observe the masticatory function for 1 week and 1 month (Table 2). It can be seen that ROM was stable, no deflection, no pain in muscle and TMJ palpation, those was no pain in load testing, elimination of TMJ click, patient can tolerate

for the new overbite (from 6 to 5 mm), overjet (from 5 to 3 mm) and VDO (from 14 to 17 mm inter cementoenamel junction). It is suggested that the anterior guidance formed from the diagnostic wax-up is correct and occlusal reorganization can provide a stable occlusion to maintain the VDO during MI and do not cause deflection of the mandible. The success of increasing the VDO make be the patient has healthy TMJs.¹²

For the phase 2 treatment, the anterior restoration should be done before the posterior because anterior guidance is the most important determination that must be made when one is restoring an occlusion. This anterior guidance of definitive denture copied from the transitional denture and then provides definitive posterior restoration. This will create stability in ICP and avoid damage in excursions.¹²

For the type of restoration, we used fixed partial denture because there is a correlation between masticatory efficiency and maximum molar bite force of the masticatory system. It is the greatest bite force and masticatory efficiency values compared to the removable partial dentures,³⁵ and more predictable and results in a higher adaptation level and the negative signs and symptoms were self-limiting.³⁶ For the material, metal-ceramic restoration was used because the longitudinal study of 515 metal-ceramic fixed prostheses by Walton³⁷ showed that an overall success rate of 96% at 5 years, 87% at 10 years and 85% at 15 years.

Before cemented the definitive restoration, should be monitored and complete the MFA to verify that treatment was effective. This monitor is important in this case because the study by Abe *et al.*,³⁸ showed that the position of the main occluding areas (functional cusp) in the FPDs tended to be less stable; and some experimental evidence that small acute changes might provoke transient symptoms in subjects with a history of past TMDs.³⁹ In temporary cementation of definitive denture, record and observe the masticatory function in 1 week (Table 3). It can be seen that ROM, overbite, overjet and VDO are stable, no deflection, no pain in muscles and TMJs palpation, no pain in load testing. It is suggest that occlusal reorganization of the definitive denture copied from the transitional denture can provide a stable occlusion and the functional cusps do not cause deflection of the mandible.

In periodical control phase, observe with MFA (Table 4) showed normal value of ROM, no deflection, no pain in muscles and TMJs palpation, no pain in load testing, patient can tolerate for the new denture (feel comfort, chewing better than his old denture, and no speech concern) after 1 year post cemented evaluation. It is suggest that the diagnostic, treatment planning and prosthodontic treatment of this case is correct.

From this case, it can be concluded that the application of MFA is very important and must be done in the diagnostic finding for treatment planning in every case of prosthodontic rehabilitation.

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