



Review Article

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# Understanding Temporomandibular Disorders

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## Abstract

Temporomandibular disorders represent a puzzling challenge to both researchers and clinicians. In the meantime, researches continue to dig deeply in patho-physiologic mechanisms that seems to be an appearance of intricate interaction of genetics, neuro-genetics and neuroscience. On the other side, the clinicians have difficulty to adapt this scientific finding in their daily practice and the majority of them tend to find the most comfortable and rapid solution to offer to their patients.

This article addresses how to cope the findings of different researches on Temporomandibular disorders in organizing the treatment protocol that best fits for our patient needs in daily dentistry.

**Keywords:** Temporomandibular Disorders, Bio-Psycho-Social Model, Muscular Accumulative Trauma, Muscular Compensation, Postural Receptor, Tonic Postural System.

## Introduction

Temporomandibular disorder (TMD) represent an inclusive-umbrella term that encloses muscular and joint disorders that disturb the stomatognathic system [1]. The age range most commonly affected by TMDs is people from 20 to 40 years of age.

The most common symptom is pain around the jaw joint, principally during activity, opening - closing the mouth and in severe cases during talking. The pain commonly is felt on one side. Other symptoms can include neck and shoulder pain, headache, limited range jaw motion, and popping or clicking sounds when chewing or opening the mouth. Even though popping or clicking not associated with pain are not considered symptoms, and consequently are not relevant for the diagnosis. Symptoms of TMD represent either as singular signs or in different combinations with one another, and the clinical picture is directly related to the tissue involved.

The definitive classification isn't yet settled up and the debate is still ongoing, anyway one of the most used classification system described in literature is the classification system used for the diagnosis described by J. Okesson according to whom we have 4 main categories: muscular disorders; joint disorders; chronic mandibular hypomobility and growth disorders [2,3]. A person

may have one or more of these conditions at the same time. It is very interesting the fact that TMDs may co-exist with other painful conditions and disturbances, such as fibromyalgia and Obstructive Sleep Apnea or chronic fatigue syndrome. However, the exact correlation of these variety that may co-exist is not clear. Further investigations are needed to clarify if they share the same micro-pathologic mechanisms, the same etiologic factor, or they are part of a disturbance chain. Rheumatic disease, such as arthritis, may also affect the temporomandibular joint as a secondary condition. The exact relationship between arthritis and TMD conditions is not known. The pathological mechanisms underlie on TMDs are not well understood and why symptoms may disappear, improve or worsen suddenly, while for others, the condition causes long-term, persistent, and debilitating pain.

## Epidemiology

In a study conducted by Ohrbach R. et al. 1988, when people with TMD histories are re-assessed after five years period of time 50% of them reported no pain, and considerably improved pain was reported in another 14% of patients [4]. In only a fraction of cases we see the progression of acute TMD disturbance into chronic



disorders. In dispersion through the patients that receive treatment for acute TMDs, 57-71 % of them report serious symptomatology after 6 months the group of patients [5,6]. Prevalence of Painful Temporomandibular Disorders and Correlation to Lifestyle Factors among Adolescents in Norway has shown that: 7% experienced TMD-P.

The gender ratio is 3:1 with female risk three-times greater compared with male, and the age range has a median in 17 years-old, and the intensity of pain was higher on female compared with male. Headaches and menstrual pain were more severe among TMD-P patients compared to controls. TMDs patients were more likely to be physically passive, to live in urban centres and with divorced or single parents. The authors suggested that: Gender, health, lifestyle, and environment factors were associated with TMD-P [7].

A systematic review of epidemiological studies concluded; the prevalence of TMD in women was 36% to 52%, while that in men was 16% to 36% point out the importance of gender in the development of TMD, when the female gender had a two-time greater risk to develop TMDs compared with men [8-11]. This gender preference suggests a possible correlation between TMD & hormonal balance, especially with the level of estrogen and also the level of stress that alters directly the hormonal level. Berger et al. [2] trying to explain the correlation between TMDs and hormonal levels suggest consideration of the dual action of estrogen when planning future studies on its association with TMD.

### Etiology

Various etiologic factors are considered, many studies and researches are conducted aimed to reveal the real etiologic factor causing the TMD. Unfortunately, the reason why some patients exhibit TMD symptoms while others do not remains unexplained regardless taken into consideration all presupposed etiologic factors.

### Researches findings

At 1992 at the Journal of Craniomandibular Disorders: Facial and Oral Pain, was published the article presenting the Research Diagnostic Criteria for TMD (RDC/TMD). The cornerstone foundation of this diagnostic approach consisted in five pillars:

- a. A bio-psychosocial model to evaluate different disease and illness.
- b. Epidemiologic data for astute allocation of signs and symptoms in correlation to sex and group age and to interpret the population benchmarks from which disease could be better describe.
- c. A dual-axis system known as bio-psychosocial system created by the combination of two parallel components: Axis I and Axis II. The axis I represent the physical diagnoses or

biological component and the axis II represent the psychosocial profiles of the bio-psychosocial model.

- d. Functionally unified definitions of terminology along with accurate blueprint for the clinical examination as well as the strict arrangement of findings and precise protocols, for required reliability and validity studies; and
- e. Recognition that the initial effort required future data to be generated as the evidence basis for inevitable revisions [1].

This protocol was proposed to be used in clinical setting since it supports diagnostic activities ranging from screening to definitive evaluation and diagnosis. Axis I diagnostic algorithms from Research Diagnostic Criteria for Temporomandibular Disorder (RDC/TMD) has been proved to be reliable, but the its Validation has been demonstrated to be below the target, more concretely with Sensitivity of  $\geq 0.70$  and specificity of  $\geq 0.95$ . [12,13].

Investigating the underlying etiologic factors that elucidate the progression and transition of acute TMD pain to a chronic one, the OPPERA study in 2016 [1,14] monitored 2,737 men and woman, with group age 18-44 years recruited at four U.S. study sites.

The follow-up period of this study had a median of 2,8 year. The results of this study shown that: only 260 participants developed TMD, with an incidence rate average of 4% per annum. The incidence rate was affected and determined by the combination a wide range of risk factors, more precisely by socio-demographic environment, psychological factors, clinical orofacial features, health status and individual pain sensitivity and threshold. This study had used a novel method of multivariable analysis to simultaneously evaluate influences of 202 phenotypic variables.

The strongest inputs to TMD incidence were made by variables of the health status domain, successively followed by variables of the psychological and orofacial domains. The weakest or modest inputs to TMD incidence were represented by variables of pain sensitivity and autonomic function domains. Independent predictors to TMD incidence were represented by the age and the study site.

The OPPERA study had proved that the genes implicated as potential risk factors for development of TMD were not only two genes formerly accepted, but more other five genes.

- i. Serotonin receptor 2A (HTR2A) (encodes a receptor for the neurotransmitter serotonin)
- ii. Catechol-O-methyltransferase (COMT) (encode an enzyme that regulates levels of catecholamines, including the neurotransmitters dopamine, epinephrine and norepinephrine)
- iii. Glucocorticoid receptor (NR3C1)
- iv. Calmodulin-dependent protein kinase 4 (CAMK4)
- v. Muscarinic cholinergic receptor (CHRM2)

- vi. Interferon-related developmental regulatory 1 (IFRD1)
- vii. G-protein coupled receptor kinase 5 (GRK5).

Separate analysis of 358 genes that determine pain found a few novel genetic cooperation's with intermediate phenotypes which, themselves represent risk factors for TMD, indicating new avenues to research biological pathways contributing to TMD [15].

The findings thus far from OPPERA's studies of first onset TMD and chronic TMD show unequivocally that TMD represents a complex disorder that has to be conceptualize within a bio-psycho-social model of illness. It's a misnomer and now not appropriate to consider TMD solely as a localized orofacial pain condition. Furthermore, it's irrelevant to envisage only one cause, even more to suppose that any one cause can be needed or sufficient enough. For the bulk of individuals with chronic TMD, the condition may be a multisystem disorder with overlapping co-morbidity [16-24].

Which absolutely drive the demand for the update of both RDC and DC and to a new one, far more inclusive. Diagnostic systems should be dynamic and inclusive. As an example of this dynamism, an axis III is envisioned as a parallel construction to axes I and II. Axis III would present conceptual issues embedded within the "bio" a part of the term "bio-psycho-social" apart from those biologic aspects present in axis I. Meanwhile the axis I will represent the physical diagnosis the axis III will exemplify the underlying mechanisms absent from both RDC/TMD and DC/TMD, which are the patho-biological processes that provide the TMD phenotype. So, the wide range of biological inputs like genetics, epigenetics and neuroscience will be transferred as diagnostic findings through the axis III. Clinical pain researchers over a few years have suggested that a physical diagnosis won't be needed for chronic pain disorders once mechanisms supported axis III factors are established [1]. Not surprisingly, now is mandatory to include into comprehensive phenotypes of chronic pain and TMDs the genetics, epigenetics and neuroscience. Obvious candidates include biomarkers broadly conceived [25] and changes in glial cells related to persistence of pain [26] for specifying standardized diagnostic categories pathognomonic of chronic (TMD) pain. The interaction of genetics and epigenetics with advances in brain neurosciences permits the study of the brain-behaviour interface [27]. Outputs from interdisciplinary research will seeming lyre cast how disease and illness diagnoses are eventually determined.

### Clinical Difficulties

The clinician faces serious difficulties and confusion in treating chronically puzzle diseases like TMDs. Three main factors lead to this confusion including:

1. The pathobiological mechanisms of these group disorders are still under investigations and not well understood.

2. As dentist we are taught to perceive uni-dimensionally. A diagnosis corresponds to a treatment protocol that works for all patients, or almost all, for example: carious lesions and it is almost impossible for us to perceive complicated disorders like TMD where a treatment protocol works for some people, but does not work for the others. This one-dimensional perception has narrowed our vision and we have fallen into the vicious circle of: Clinicians tend to see what they treat and treat what they see! If the clinician sees as the cause of TMD the teeth, he treat with occlusal equilibration. If the clinician sees the cause of TMD the activity of masticatory muscles, treat with splint appliances, and if the clinician sees as the cause of TMD the TMJ, he will treat TMJ joint surgically.

3. We are NOT trained to think outside the box. In most schools, the predominant form of education is to develop intellectual thinking: divide reality and put it into boxes. Dividing the human body in different systems, according to those we have plenty of specialties. Intelligent thinking, on the other hand, is to see unity in reality. We are used to see the masticatory system as an isolated entity within the body. BUT THE TRUTH IS, THE BODY IS ONE AND INDIVISIBLE. King, Jankelson and Basmajin [9-11] concludes that: Occlusion is an extension of general postural considerations that goes beyond the understanding of cusptofoss a relationships. It is a dynamic phenomenon that includes the afferent pro-prioceptive sensory input affecting the central nervous system mechanisms and resultant states of muscle tonicity. There seems to be a control relationship within the body that puts the dental system in a causative role of symptomatology, where a dysfunctional dental occlusion creates adverse effects in many distant areas of the unified body. Fonder has called this the dental distress syndrome [20] since 1973. In 2005 D'Atilio & other concluded that: The alignment of spinal column seemed to be influenced by the dental occlusion [17]. On the other hand, by removing the interference of the masticatory system, we see that the body has no more torsion [28-32].

In medical school, they teach us how to treat the disease, but NOT how to treat the PATIENT. Until we see the whole unity, the intricate relationship between the individuality of the patient and the pathogenic mechanisms of the diseases we cannot perceive and treat complex disorders such as TMD.

As clinicians, we shouldn't lost our time trying to find out the exact etiologic factor, but rather to concentrate our energy on: What we can do to help the patient to manage this disorder and giving time to the researchers to reveal the interaction between neurobiological mechanisms and environmental exposure that cause that disable disorder. Framed differently, what can we do to reduce or eliminate pain, to restore normal jaw function, to restore normal life-style function, and to reduce the need for future health care?

## Construction of Individual Bio Psychosocial Model for each patient

It seems that there's a silent consensus that the treatment approach must be based upon the development of individual bio-psycho-social model for every patient. The bio psycho-social model is integrative, which considers that neurobiological processes and environmental factors are equipotent to elucidate not only diseases, but also responses to treatment. Environmental events or exposures successively influence the expression patterns of multiple genes and also the activity of a range of signalling pathways that manifests as quantitative and qualitative intermediate phenotypes that outline the TMD patient at a selected point in time [15]. The body as a biological universe is continually exposed to several influences. The resultant influence may be a combination of the amount, duration, amplitude, and frequency of all the individual influences. It overcomes these through two mechanisms: adaptation (connective reaction to an influence) & compensation (muscular response to an influence). Adaptation is that the reaction of the connective tissues that influence into cellular level to reorganize the biochemical and hormonal reactions to continue protecting the homeostasis irrespective of the influences. If the sum of harmful influences over a given period of your time exceeds the individual capacity for progressive adaptation, or if adaptability generally decreases, the system will fall out of the equilibrium. At this moment the organism uses another mechanism called: Compensation, as a muscular response to an influence that's the premise of the Adapted Posture. Muscle compensation isn't dumb but speaks with clinical signs.

it's our responsibility as clinicians to note and evidence these signs of muscle compensation. But, why is muscle compensation dangerous?

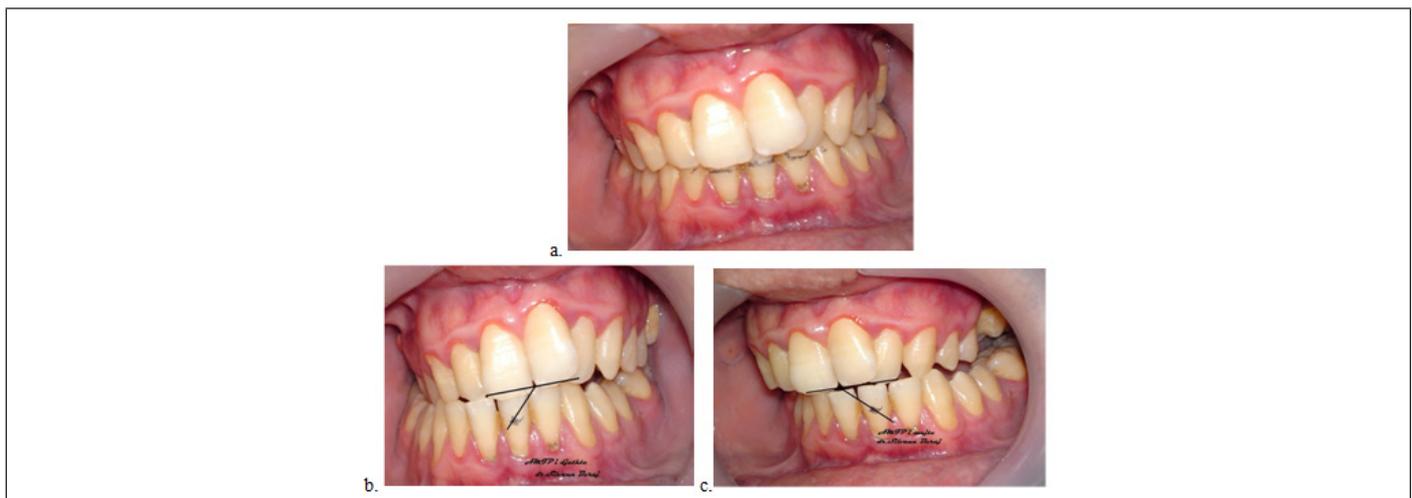
If the patient encompasses a muscular compensation for a chronic period of your time because of the para-functional activity or position, cumulative trauma will occur per the subsequent formula:

REPETITION + FORCE + POSITION + TIME = ACCUMULATIVE TRAUMA.

Cumulative trauma is that the basis of structural deformation. Excessive stress over an extended period causes us to lose the flexibility to settle down physiologically and psychologically. it's the gateway to disease. Adapted posture is an alarm that ought to wake us up.

What can produce cumulative trauma? Simple daily routine actions that don't respect body ergonomics, such as:

- a. The dynamics of the mandibular movements during chewing. We check with a vital clinical index: the functional masticatory angle of Planas (AMFP). This index represents the degree of mandibular freedom in lateral movements. Clinically, patients with equal AMFP have an order of alterations on either side in masticatory cycles, while those with non-equal AMFP have a preferential side use within which the worth of AMFP is a smaller amount than will obviously produce accumulative trauma on this side (Figure 1).



**Figure 1:** a- Centric Occlusion position. b- Right AMFP. c- Left AMFP.

b. The position within which we sleep. As humans, we spend 25 years of our life sleeping (8 hours / day), so sleeping in an exceedingly parafunctional position will represent the identical formula of cumulative trauma.

c. Working conditions (sitting posture for long periods of your time creates serious problems with the posture).

d. Parafunctional and positional habits like chewing gum, navigating in internet through cellphone in inappropriate position, the habit of using high heels, biting the nails, biting the lips or mucosa, clenching or bruxing the teeth, etc.

Between the resultant influence and therefore the capacity for progressive adaptation is also achieved a physiologic state of equilibrium, and therefore the patient will report no history

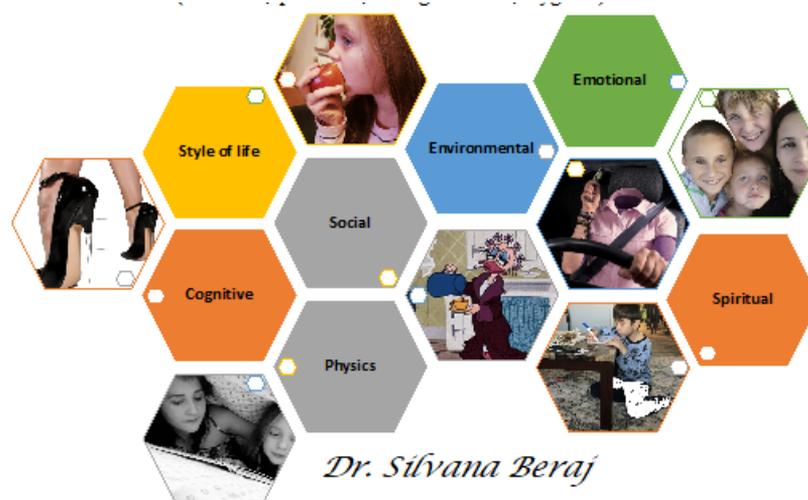
of symptoms or functional disturbances, but the presence of harmful influences is also expressed with signs, detect only by an astute clinician. If, at a particular point in time, the sum of harmful influences exceeds an individually variable threshold, or if the adaptability of the masticatory system becomes generally diminished, the system will fall out of equilibrium. At this time, we'll have the complete range of clinical symptomatology notable from the patient itself.

So, it's crucial to detect the signs of muscular compensation and accumulative trauma in our patient. everybody encompasses a unique set of interrelated factors represented by the seven realms of our being which will protect or perpetuate the disease.

- a. Physical (physiological, genetic, molecular, hormonal).
- b. Lifestyle (repetitive tension, posture, eating, sleeping).
- c. Emotional (depression, fear, anxiety, anger).
- d. Social (relationships, abuse, secondary gain).
- e. Cognitive (attitudes, understanding, honesty).
- f. Spiritual (faith, beliefs, purpose).
- g. Environmental (accidents, pollution, disorganization, hygiene).

(Figure 2) So, we need to understand the intricate interaction between muscular tension and cognitive psychology/ brain biology within individual physiological homeostasis. We must investigate and analyze the pattern of muscular behaviour of the patient. We should be astute enough to reveal the postural pattern and para-

functional habits and positions of the patient. Our habitual postures are connected with emotions and habitual thoughts in a strange intricate dance that creates the core of the habit itself. We are not aware of our habits, so the only way to unravel this loop is to become aware of our postures. We usually stay and move in ways that meet social and emotional needs or avoid colliding with them. Our positions meet our needs. What is the posture? Gardiner [31] defined the posture: The attitude assumed by the body either when the body is stopped or when it is moving. The posture is achieved as a result of the coordinated action of several muscles that work to maintain stability. So basically, it's muscular behaviour to maintain stability. Posture is a dynamic pattern of learned muscular reflexes, behavioral habits and muscular adaptive responses and finely skeletal adaptive response. Framed differently, postural analysis is the first clue for revealing psychosocial exposures, we need to translate the human mind in biological terms and "Physical hypnosis" is the key to this translation. Hypnosis the art of becoming fully aware of who you are, which helps to deal with emotional and psychological problems to drive and unravel the anxious and to be free of emotions. Physical hypnosis unravels the pattern of muscular behaviour and behavioural aspects that influence muscle dynamics. We must perceive the disease as a melody. The patient must be perceived as the orchestra that plays this melody. The resulting sensation will depend on the harmony between all the components of the orchestra (muscular harmony of the patient) directed by the leader (nervous and limbic system). Different orchestras, different results. The same orchestra, different emotional situations, different results. Posture is how we are playing MELODY!



**Figure 2:** The interaction of seven realms of our being.

In other words, physical hypnosis investigates the Tonic Postural System, which is a neurologically complex system in charge of creating the basic muscle tone, necessary to counteract natural forces: atmospheric pressure (weight of air above the body) & gravity, allowing the body to function in harmony. The Body as a unique system is in a closed cybernetic, self-powered loop. It

has superior centers, peripheral receptors and system buffers to balance the posture. Receptors: Eye; Mouth (great disturber of the tonic postural system); Foot. We need to investigate the relation between the receptors' activity (eyes, mouth, feet) and what pathology had affected the tonic postural system [32].

Our investigation should be focused on: Clinical exam and additional analysis {Food intolerances: Amino-acids tests which can help in the differentiation between a real food intolerance and a postural problem [33]}. Controlling the patient's biochemical and hormonal balance is important because it helps reveal contributing factors including those that initiate, perpetuate or result from the disorder but somehow complicate the problem.

Clinical assessment: has three main components:

1. Oculomotor system (Oculomotor nerve): the performance of the eye as a postural receptor (Figure 3).



Figure 3: The eye is postural report.

2. Masticatory system (Trigeminal nerve): the performance of the mouth as a postural receptor (Figure 4).



Figure 4: Elimination of Body torsion by removing interferences from masticatory system.

3. Pedal system (Sciatic nerve): the performance of the feet as a postural receptor (Figure 5-7).

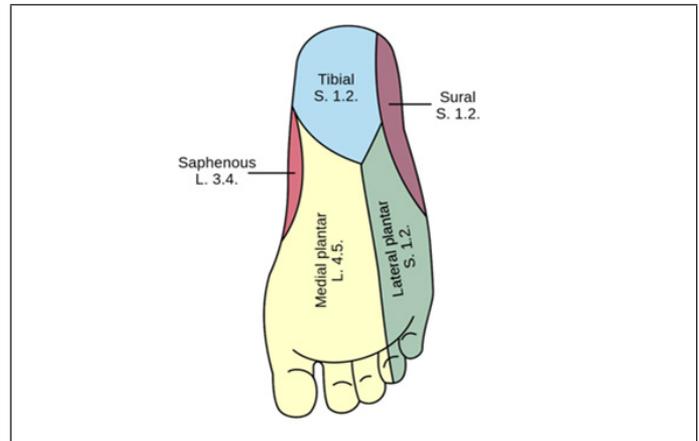


Figure 5: Sciatic nerve originates from ventral rami of spinal nerves L4 through S3.



Figure 6: Foot as a Postural Receptor. A. Anterior Review B. Posterior Review.

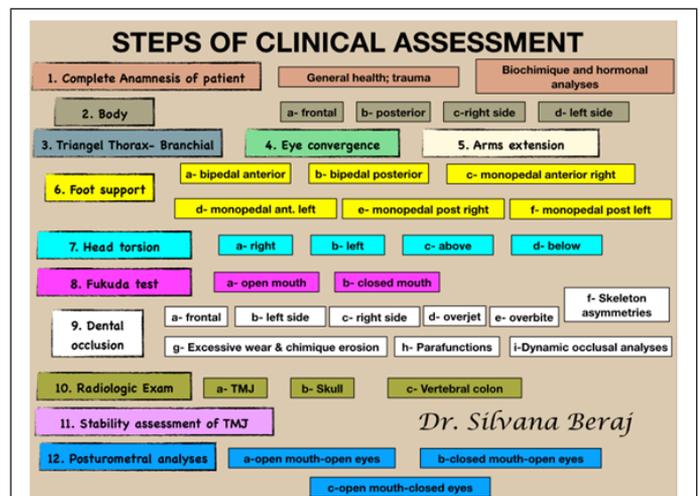


Figure 7: Scheme of clinical assessment steps.

### Treatment approach

Our treatment approach should be led by a clear panorama of the result. In this line is crucial to differentiate if we are dealing with dysfunction or dysmorphism. According to Merriam-Webster dictionary, Dysfunction is defined as impaired or abnormal functioning, meanwhile, Dysmorphism is defined as an anatomical

malformation. All we can do in dysmorphism is trying to improve, meanwhile in dysfunction we can treat.

Our treatment protocol should be guided by the quote "PRIMUM NON NOCERE!" which means we decide for the treatment approach only when we are 100% sure of what we are doing and know exactly what result will be produced by this treatment approach. Only in this way we can avoid irreversible damage in our patients.

Protocol: a-de-programation of the body: b-balance the body. c- re-programation of the body:

a. De-programation of the body: The objective is to cancel the disturbance (eye, jaw position, Para functional activity or Para functional posture, etc.). Splints deprogramming, general relaxation practice, meditation, hypnosis and abdominal breathing, physical exercises, etc.

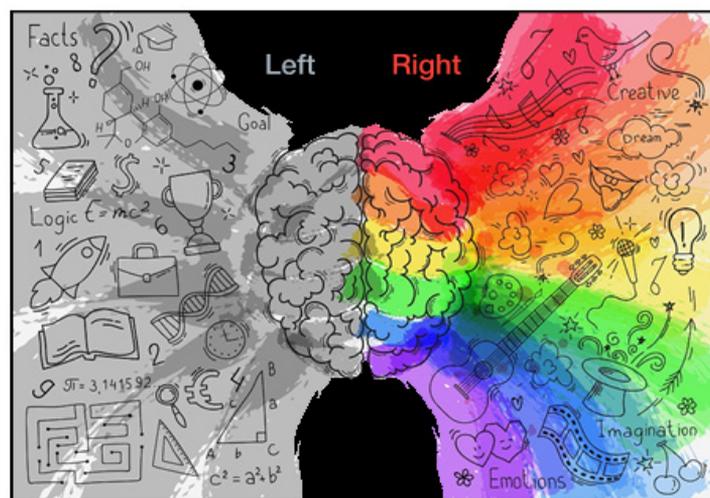
b. Balance the body. The goal is to keep the body in a position with less energy spent and general comfort. Once the postural tonic system is in balance, we must go to the next step.

c. Re-programation of the body: At this time, we must provide the necessary guidance for a harmonious and balanced intricate interrelation of the muscular orchestra of the universe

called: BODY.

It's obvious that this treatment protocol could not be performed by the dentist alone, but it requires the cooperation of different specialists to cancel the particular disturbance and reorganize a new and healthy equilibrium for the patient's body.

The last but not least step on the treatment is: Educate the patient. Education of patient requires engaging of Cognitive behavioural therapy (CBT) with somatic education therapy. No amount of exercise can fix postural abnormalities. The only way to permanently alter the posture is to alter the habits. Through CBT we can make the patient aware of misuse of body behavior (habits). Through somatic education technique we aim to erase the incorrect postural reflexes and replace them with a new pattern of movements. As dentist our focus is in somatic education of tongue. The intrinsic muscles of the tongue are involuntary and soldier to perform postural reflexes learned under subconscious control (right side). The extrinsic muscles are voluntary and soldier for the realization of postural reflexes learned under conscious control (left side). The left hemisphere can veto its counterpart and take control. We need at least 21 days to create these new activity patterns under the control of the left side of the brain (Figure 8).



**Figure 8:** The left brain and right brain theory were created in the 1960s by the psychologist Roger W. Sperry.

One possible somatic education is presented by the combination of the Roccabado 6x6 exercise program [34] and strengthening technique of the muscles of the tongue that will improve swallowing function.

## Discussion

There is in need to clarify that not all patients need CBT and the same somatic education, but it could be necessary to re-educate before or after postural assessment. We don't have an exact formula of when to do the somatic education and which type of the somatic education, it will depend on the individual bio-psycho-social pattern of each patient and also the postural assessment.

When the perturbing stimulus comes from eyes the ophthalmologist is the specialist capable of organizing the treatment protocol, and when the perturbing stimulus comes from feet, the post urologist is the specialist capable of organizing this treatment approach, although we all must be post urologist. Framed differently, to be able to treat TMDs all medical specialties Must speak the same language and have the same holistic point of view.

Each patient requires an individual assessment, treatment and regular re-evaluations as the life is going on and with that all the hormonal, biochemical, neurological balances may be altered. For

this is crucial to educate the patient on the delicacy of the treatment and the regular basis of the re-evaluations.

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