MALOCCLUSION AND POSTURE (THIS IS QUITE A TECHNICAL PAPER!)

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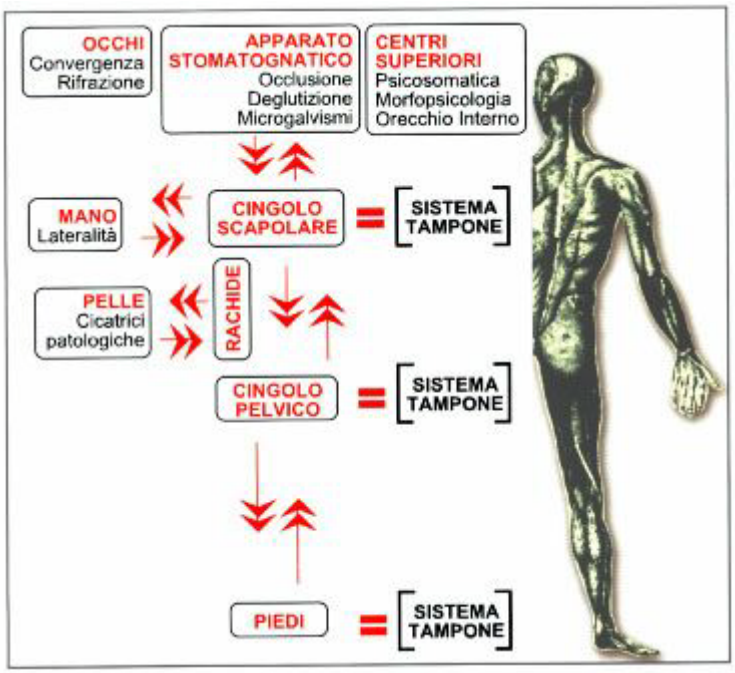
The Tonic Postural System (TPS) can be described as a cybernetic system consisting in a central computer (CNS) that, by processing the information coming from the periphery (receptors), outputs a set of signals that it then conveys to the specific organs activated by efferent nervous fibres (muscles). In this way, the Central Nervous System manages our balance and orders to the muscles the adapting inputs they have to fulfil in order to maintain the centre of gravity; so it accomplishes the main task of coordinating the postural muscles.

According to these remarks we can state that incorrect posture is like a mechanism of defence adopted by the body to counterbalance problems or disorders affecting one or more peripheral receptors. In fact, the PTS is able to self-adapt in its own balance, but it is not able to carry on a self-correction. Feet and eyes are considered as the most important postural receptors, because they influence both the static and dynamic postural adjustment; they are both eso- and endoreceptors, because they are involved both in the extroceptivity and in the proprioceprivity. The TPS is also influenced by other receptors such as the stomatognathic apparatus, the ear (vestibular apparatus) and the skin. Organs activated by efferent nervous fibers are tonic or tonic-phasic muscles.



Pic.1 Scheme of the TPS (according to Bricot)

1. Clinic

The scientific research is still involved in discovering the determinism and the influence of the whole muscles and skeletal system on the function or dysfunction of the stomatognathic system and vice versa.

Etiologic hypotheses suggesting an interdependence between the tonic postural system and the stomatognathic system are based on considering the complex relationships between the

stomatognathic system and the central nervous system **(CNS).**

The main causes that can give rise to an altered function in the cranio-mandibular relationship are: alterations located above all on the bones and dental level, occlusal interferences, general muscolo-skeletal disorders and disorders concerning the emotional sphere. Occlusal instability is considered as the main risk factor able to give rise to a dysfunction of the stomatognathic system.

The close relationship between the spatial arrangement of the different skeletal parts of the body and the continuous adjusting action exerted by the CNS on the muscles, through processing the information coming from the dental, muscles and joints proprioceptors, produces continuous variations of the posture of the head, of the position of the jaw and of the hyoid bone.

During the 1930s Schwarz noticed that the position of the jaw at rest was influenced by the position of the head.

During the 1960s Robinson focused on the relationships between the head posture and the function of the stomatognathic system by means of a research on the electric activity of the chewing muscles. He also analyzed the variation of these relationships according to the different head postures.

In 1973, Mc Lean analyzed the effects exerted on the dental occlusion by a change of the head position. In fact he observed a variation of the precontact points of the occlusion while moving the body from a lying position to an upright position. He also proved that whatever variation of the position of the whole body could influence the oral proprioceptors causing a displacement of the jaw.

In 1976 Funakoshi and other authors analyzed the relationships between the variations of the head posture and the functioning of the chewing muscles and attempted to discover whether and how some occlusal interferences could influence the functioning of the chewing muscles. A group of 320 patients underwent a bilateral electromyography of temporal, masseter and digatricus muscles performed with different head postures; authors also added to some patients an artificial precontact which was removed afterwards. They obtained as result different electomyographic values according to the different head posture; so they were able to prove how an occlusal interference could cause an incorrect muscles reaction.

Capurso and other authors analyzed the relationships between the cranio-cervical posture and the different malocclusion types. They evaluated 204 patients presenting clear anomalies concerning the posture and the occlusion. The most common combination was a second skeletal class with an hyper divergent profile associated with a foreword displacement of the cervical-cranial unit.

Gatti Colangiolo and other authors highlighted the correlation between the dorsal hyper kyphosis and the dental malocclusion of second skeletal class by carrying out a radiographic examination on 36 patients.

Myata and other authors carried out a very interesting experimental trial. They analyzed the relationship between the stomatognathic apparatus and the remaining parts of the body by evaluating, through the electromyography, the effects of iatrogenous occlusal interferences

on the functioning of the antigravity muscles in the upright position. Results proved an increasing of the muscles functioning already a day after the introduction of the occlusal interference; the muscles function normalized after removing the occlusal precontacts. These results highlight the importance of an evaluation of the function of the antigravity muscles while verifying whether the implemented orthodontic therapy is correct or not.

In 1992 Libertucci proved how an alteration of the relationships among the teeth, of the dental-tongue relationship and of the cranio-mandibular relationship causes an unbalance, that starting from the chewing muscles, is able to influence the whole muscular system; by means of a simple postural examination it was possible to evaluate the resulting damage.

In 1992 Martensmeier and other authors evaluated 126 patients with an average age of 11 : 50 % of them had occlusal relationships of second skeletal class, 30% of them had occlusal relationships of first skeletal class and 20% of them had occlusal relationships of third skeletal class. Then they analyzed the relationships between posture and malocclusion. The experimental trial was carried out, above all, by analyzing and comparing the teleradiographies performed before and after the treatment. At the end of the treatment the authors noticed that patients with a first or second skeletal class presented (before the treatment) a marked cervical lordosis that decreased after the orthodontic treatment, whereas patients with a third skeletal class presented (before the treatment) a cervical kyphosis that didn't change after the treatment.

Morri and other authors ('97) proved, through a cephalometric evaluation of the soft tissues of the head, that there are different postures of the head according to different types of occlusion.

Balercia in 1993 maintained that a deviated swallowing, or at least a swallowing with a maximal intercuspidation position obtained in a physiologic way, forced the concerned muscles to work in a different way and displaced the position of the head as regards to the trunk; in this way a negative influence is triggered along the whole descending muscles chain. These observations were backed by the results of the evaluation performed through the stabilometric platform that proved the variations of the barycenter of the body originated during the swallowing.

So several experimental trials highlighted and proved the important role of the occlusion in influencing the postural alterations. Nowadays the whole scientific world agrees in asserting that an alteration of the stomatognathic apparatus exerts its effects on the whole postural arrangement. Certainly, these effects are more visible, from a clinical point of view, on the upper parts of the skeletal structure (posture of the head, shoulders tilt or shoulders rotation, increasing of the cervical curvature) and trigger a set of different symptoms (headache, otalgia, cervical pains, shoulder blade pains, scapulo-humeral periarthritis, paresthesia of upper limbs, etc.).

2. Neurophysiology

In order to analyze what kind of reflex can be triggered by a precontacts or by whatever occlusal interference on the stomatognathic apparatus and then, as consequence, on the whole posture, we must, first of all, focus on neurophysiology and on the complex receptor system that is involved in the occlusion and in maintaining the posture of the jaw. We will

analyze the receptors of the periodontium, of the tempero-mandibular muscles and joints.

Different kind of receptors are located into the peridontium. Receptors of first not nociceptive type are able to inform about the intensity, the direction and the speed of application of the forces on the crown of the tooth (rapidly adapting, sensitive to forces of 1 gram). There are also receptors of second nociceptive type whose task is to measure strong tractions exerted on the tooth, thermic, chemical or intraligamentous pressures (slowly-adapting, sensitive to forces of 3-10 grams) and unmyelinated fibers.

The receptors located into the muscles are the neuromuscular spindles, that measure the variations of the muscles length, and the nervous endings, that accomplish a nociceptive task. The receptors located into the tendons are the musculo-tendineous corpuscles of Golgi that inform about the contraction's force of the muscle.

Into the TMJ it is possible to observe four types of mechanoreceptors: two with a high-threshold and two with a low threshold. Some of the low threshold receptors are responsible for the postural and kinesthetic sensitivity and contribute to regulate the postural tonus by coordinating the muscular activity that allows the movement, some other low threshold receptors, deeply located, trigger discharges at the beginning of tensive modifications and function as receptors of acceleration and deceleration. On the other side, high threshold receptors activate in case of high capsular tension, they are located on the surface of the lateral capsular ligament of the TMJ. Kinesthetic joints receptors decide the position and the movement of the joints.

From a physiological point of view, a nociceptive stimulus occurring at a muscular level causes a stimulation of the motoneurons of the muscles flexors and, at the same time, an inhibition of the ipsilateral extensor muscles and a contraction of the controlateral extensor muscles.

Through this monosynaptic reflex we are able to move the limb that received the nociceptive stimulus.

So at a stomatognathic level we should focus on nociceptive and postural reflexes.

Nociceptive reflexes originate from peridontal receptors of second type, postural reflexes originate from muscles and joints. So the nociceptive reflexes will exert their control on the pressure, whereas the postural receptors will exert their control on the position, obviously they can also collaborate.

Nociceptive peridental reflexes originated by a precontact will give rise to a flexor reflex; postural reflexes will give rise to an extensor reflex. When a tooth is subject to an anomalous precontact, ipsilateral elevator muscles will relax allowing, in this way, the contraction of the depressor ipsilateral muscles (flexor muscles). If the stimulus changes into an ongoing stimulus, muscles will displace the jaw in a more comfortable intercuspidation, but as consequence they will cause an alteration of the posture and of the electromyographical pathway.

The postural reflex, as reflex, is an involuntary defense movement that causes a deviation from the original movement scheme and as consequence an increasing of the work of the system. The system won't work in economy, trying to save up as many energy as possible,

but, in order to avoid the obstacle of the precontact will be forced to automate new movements engram, that will be more fatiguing and will cause a heavier expense of energy.

The above mentioned mechanism gives rise to a new muscular work and consequently to an alteration of the ectomyographical values.

The precontact, because of the above mentioned reflexes, causes an ipsilateral hypotonous and a controlateral hypertonus, when the EGM is at rest. Normally, high values in relax of a messeter muscle are caused by an anterior controlateral dynamic precontact, whereas high values in relax of a temporal muscle are caused by a posterior dynamic precontact. Generally anterior contacts cause a controlateral displacement of the jaw, whereas posterior precontacts cause an ispilateral displacement of the jaw.

In case of precontact we can observe also an alteration of the external pterigoideus, that will be higher on the precontact side in the same way as the posterior temporal muscle. Obviously this will trigger descending effects that will involve and concern the neck's muscles; first of all there will be an alteration of the values of the upper ipsilateral trapezius muscle and of the controlateral sternocleidomastoideus. In this way the head will suffer a deflection to the deviation side getting nearer to the shoulder, which will be higher than the other one. Under these conditions, the spine will present a curvature in the cervical area and inevitably, other compensative curvatures (scoliosis) will appear in the thoracic and lumbar area. Rachis involvement causes, as reflex ,adaptation imbalances above all charged to the iliacus-psoas, that, because of their insertions on lumbar vertebrae, on iliacus bone and on the upper femoral bone, will cause an inclination of the pelvis compared with the spine and a different length of the lower limbs, that ca be noticed when the patient lies.

So the consequences of the dysfunctions of the stomatognathic apparatus can be easily observed from a semeiologic point of view by means of a clinical postural test. Evaluated by means of a posturoscope, the patient will present alterations of the spatial relationships among the different segments of the body; so now it is possible to carry out a differential diagnosis (for instance by means of a modified Meersseman test) to evaluate in a precise way the influence of the occlusion on the whole body arrangement.

We have also to focus on the clinical symptoms of the malocclusion. Beside the classical local symptoms (such as pains affecting TMJ with noises while opening and closing the jaw, facial pains, tension of the chewing muscles, and easy tiredness by chewing) it is possible to notice some more general symptoms (such as headache, vertigo, cervical pain, lumbar-sacral pains, ear buzzing) that normally are not considered to be directly related to a dysfunctional pathology. Although in most cases there are not scientific studies that could prove in an incontestable way the direct clinical relationship between these general symptoms and the malocclusion, we have to admit that sometimes the clinical objective evaluation overcomes the scientific theory. So this observation entitles us to claim that the disappearing or the decreasing of the general symptoms that we can observe during a gnatologic therapy proves, by itself, the close anatomic and physiologic relationship between the mouth and other anatomic areas, even if they are located far away from the mouth.

In an interesting statistic experimental trial was carried out by Massaiu and his colleagues on 66 patients treated because of a dysfunctional syndrome of the TMJ. Authors noticed that in most of the analyzed cases there was also a decreasing or a disappearing of other more general symptoms that could be considered as secondary to the treated pathology.

Specifically, headache disappeared (77.7 %) or decreased (9 %), cervical pains disappeared in 70 % of the treated cases and decreased in 11 % of the treated cases, lumbar-sacral pains disappeared in 74 % of the treated cases and decreased in 20 % of treated cases, ear buzzing disappeared in 80 % of patients and decreased in 10 % of patients, vertigoes disappeared in 80% of patients and decreased in 15% of patients. The most remarkable results is the almost complete disappearing of symptoms (lumbar-sacral pains, vertigoes) that are commonly considered as symptoms to be treated by means of a postural approach. All the above mentioned results prove the close relationship between the mouth and the whole postural arrangement.

3. Conclusions

As conclusion we are entitled to claim that many postural painful symptoms are caused by the fact that these patients have not a stable occlusion, because some clinical situations (such as precontacts, extrusions, migrations, missing teeth etc.) cause an abnormal closing movement of the jaw. The displacement of the jaw interferes with the postural mechanisms triggering several consequences on the biomechanical and symptomatic level. These consequences are rarely correlated, during the diagnostic phase, to the dental alterations. Being aware of this correlation can be useful to modify our therapies that are sometimes only focused on the treatment of the symptoms.

BIBLIOGRAPHY

1. Ambrosio R., Bisogno M., Carano M., Esposito A.: "Occlusione neuromuscolare". ISFOM MAGAZINE, 1, 2001.

2. Balercia LP.: Fisiopatologia della deglutizione. Relazioni con occlusione e postura. DENT MOD 1993;1: 55-84.

3. Bibby RE: The hyoid bone position in month breathers and tongue-thrusters. AM J ORTHOD 1984; 85;5: 431-3.

4. Bricot B.: La riprogrammazione posturale globale. ED STATIPRO, 1996.

5. Capurso et al.: Ruolo della postura nell'eziopatogenesi delle asimmetrie e flessibilità dell'approccio terapeutico. MONDO ORTOD 1990; 15, 1: 29-59.

6. Didier H.: L'influenza dei precontatti sulla posizione spaziale della mandibola e del cranio. DENT MOD 1992; 9: 1527-1534.

7. Esposito GM, Meersseman JP.: Valutazione della relazione esistente fra l'occlusione e la postura. DENT MOD 1988; 5:923-941.

8. Gatti Colangiolo G. et Al.: Valutazione clinica radiografica dei rapporti fra dorso curvo e malocclusione. MONDO ORTOD 1990; 15: 413-417.

9. Guaglio G.: Stretta interdipendenza tra malocclusioni dentali, sindromi dell'ATM e scoliosi. RIS 1989; 6: 22.

10. Funakoshi M. et al.: Relations between occlusal interference and jaw muscle activities in

response to changes in head poisition. J DENT RES 1976; 55.

11. Libertucci M.: Diagnosi e terapia del dente neurologico. Due casi clinici. DENT MOD 1992; 9: 1521-5.

12. Manzoni T.: Fisiologia dell'apparato stomatognatico. USES - ED. SCIENTIFICHE FIRENZE; 1982.

13. Martensmeier I.: Quali correlazioni fra postura cervicale e malocclusioni? FORT KIEFER 1992; 52: 26-32.

14. Massaiu G., Toxiri G.: Scomparsa dei sintomi "accessori" durante il trattamento delle disfunzioni dell'ATM. DENT MOD 1998; 4: 69-76.

15. McLean L.: Effects of changing body position on dental occlusion. J DENT RES 1973; 52: 1041-1045.

16. Morri L., Benfenati A.: Postura del capo e rapporti occlusali. Cefalometria dei tessuti molli. DENT CAD 1997; 18: 56-64.

17. Myata T.: A study on the relation between stomatognathic system and the systemic condition concerning the influence of experimental occlusal interference on upright posture, particularly on gravity fluctuation and the antigravity muscles. NIP HOTSHIKA GAK ZAS 1990; 34: 631-45.

18. Robinson MJ.: The influence of the head position on tempuromandibular joint disease. J PROSTH DENT 1966; 16: 169-172.

19. Rocabado M.: Biomechanical relationship of the cranial, cervical and hyoid regions. J CRANIOMANDIB PRACTICE 1983; 3: 61.

20. Schwarz AM.: Position of the head and malrelations of the jaws. INT J ORTHOD 1928; 14: 56-68.