Clinical

Temperomandibular dysfunction and systemic distress

Justin Glastier[1]

Could it be that dysfunction of the jaw joints result in conditions such as scoliosis, migraine, pelvic asymmetry, pituitary and endocrine dysfunction? Could it be that dentists and orthodontists unwittingly contribute to the onset or perpetuation of these symptoms and others such as digestion problems, disturbed vision, loss of balance and tinnitus?

If we understood the cause and symptomology of TMD and how to treat it could we remove the need, for a subset of our patients, to depend on anti-depressant drug therapies, help MS sufferers with their symptoms, even delay the progression of the disease, and in extreme cases help patients who have considered suicide?

TMD itself is still thought by many to be a psychological condition of the patient rather than a very real physical, structural and mechanical problem which can disturbingly affect the muscular, skeletal, endocrine and nervous systems.

The more enlightened clinicians may realise that these complex joints and their surrounding nerves and musculature can create distressing facial pain, headaches and neck pain, but do we need to look further, as to how this condition can influence whole body systems and mechanics?

The source

Before looking at the developmental causes of TMD it is worth considering the fact that in evolutionary terms our nervous systems are programmed to bring the back teeth together in order to feed and ultimately survive.

In the case of a 'problem bite' whatever the cause, we will see the nervous system develop a habitual occlusion via neuromuscular and postural compensations to make the best of what we have and attempt to allow mastication to occur. The important thing to remember is that the teeth are dominant, the muscles and joints will accommodate.

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Penfield and Rasmussen, over a half century ago, demonstrated that almost half of both sensory and motor aspects of the brain are devoted to the 'dental area.' So, approximately half of the programming of the computer-brain, that runs the body, comes from the dental system (Fonder 1980, 1988). When confused stimuli are accepted as fact by the brain, it will in turn be sending out faulty information/feedback which will affect all systems throughout the entire body.With half truths, the brain is reporting that all is well when in fact all is very wrong. Gradually diseases appear throughout many systems of the body and when the malocclusion is eliminated we can see the reversal of these 'chronic' health problems

Normal occlusion may therefore be defined as 'that mandibulomaxillary relationship which permits all the structures directly or indirectly dependent on that relationship to function in a state of equilibrium' (Storberg).

The development

Clinicians should be monitoring the influence of posture, airway and the tongue on dental and cranio-facial development in their patients from a very early age, from as young as five years of age. Children who become mouth breathers due to partial or complete blockage of the nasal airway via hypertrophied adenoids develop changes in physiologic function of the upper respiratory tract, which results in skeletal adaptations, and alterations in craniofacial development (Linder-Aronson 1975, Dunn et al 1973).

In response to nasal obstruction, the tongue drops and the medialising/inward pressures of the buccal musculature are left unopposed. This effect is further enhanced by a pressure differential across the hard palate in the absence of nasal airflow, leading to a narrow high arched/vaulted palate (Schreiner 1996).

It is very important for the clinician to be aware of this, as the growth of the face, except for the mandible, is complete

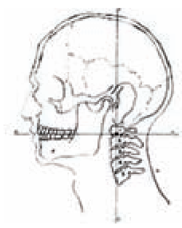

Figure 1: The apex of the combined muscular control of the mandible in all functioning move-ments is located at the dens between the atlas and axis cervical vertebrae.

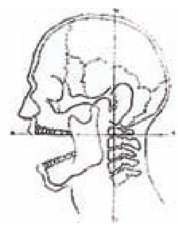

Figure 2: When the mouth opens the 136 muscles above and below the mandible pivot the jaw at the xy-axis. The condyle translates forward and downward as the mouth opens.

at a relatively early age - 60% of craniofacial development takes place during the first four years of life and 90% by age 12. Mandibular development is not complete until approximately 18 years of age (Meredith 1953).

When a patient is identified as a mouth-breather as a result of hypertrophied tonsils and adenoids, an assessment should be arranged with an ENT specialist as soon as possible to eradicate any nasopharyngeal obstruction to airflow efficiency, indeed a study by Linder-Aronson showed that following a change from mouth breathing to nose breathing, after adenoidectomy, a normalisation of upper incisor inclination, arch width and nasopharynx size occurred (Linder-Aronson 1979).

The long-term effects of airway dysfunction to the occlusion and supporting musculo-skeletal complex are many and complex but include development of lateral tongue thrust, which can create a situation of depressed eruption of posterior lower quadrants, leading to a deep overbite and distalisation of condyles resulting in TMJ compression.

As we get older, other developmental factors can affect the equilibrium of the stomatonathic triad (occlusion, nerve/muscle complex and TMJ) such as iatrogenic poorly designed dental restorations, extractions leading to tipping of adjacent teeth, poorly thought out orthodontic treatment, trauma such as whiplash, stress - though not a causal factor, it can reduce a patient’s ability to deal with the underlying problem.

Relationship to body mechanics

The importance of the dental structures in relation to whole body mechanics is easily demonstrated through a consideration of basic anatomy. The jaw and spine are gathered into one basic system by the various fascia surrounding them, so that stress or muscle spasm in either these components is reflected in tension transmitted throughout the corresponding regions via their interconnecting fascial sheath systems.

This is especially true with the masticatory/jaw system and the atlas and axis vertebrae in the neck (i.e. C1/C2 vertebrae). The mandible and C1/C2 have a unique relationship to each other.

The atlanto-occipital joint is where the skull meets the neck via C1, the joint surface of the occipital condyles (which sit on C1) have been shown to be an exact replica of the mandibular condyle as demonstrated on 50 human skulls (Thomas 2009) thus suggesting an integral role for jaw mechanics in the development of head posture.

A student of engineering Casey Guzay proposed the Quadrant Theorem (Guzay 1980), which inextricably linked the roles of the mandible with cervical vertebrae, Guzay showed that the muscle controlled pivotal axis of the mandible occurs at the dens between the atlas and axis vertebrae (Maehara et al 1982, Guzay 1985). As a result, the mandibular/jaw misalignment and dysfunction we see in our patients creates a disturbing posturing of C1/C2 (Fonder 1988) and it is these vertebrae which are intimately related to spinal and head posture and neurological well-being.

To consider how malposturing of these key vertebrae further affect spinal and head posture we must look at the relationship between C1/C2(mandibular axis) and the dura mater.

The dura mater is a thick and dense inelastic membrane that envelopes the brain and medulla spinalis. The dura of the brain lines the interior of the skull adhering closely to the inner surfaces of the bones, the spinal dura mater is a loose sheath around the medulla spinalis. It is attached to the circumference of the foramen magnum and to the frontal and dorsal aspects of the atlas and axis (C1/C2) ; it is also connected to the posterior longitudinal ligament, it descends to the back of the coccyx where it blends with the periostium (Henry 1943, Smith 1983). The malposturing of C1 and C2, through the dental malocclusion and the resultant mandibular dysfunctioning, torques the dura mater because

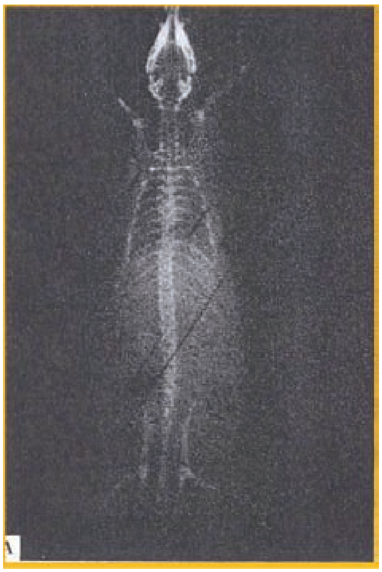

Figure 3: Spinal posture before placement of filling.

Figure 4: One week after placement - displaying spinal deformation.

Figure 5: Normalisation of spinal posture one week following removal of filling.

of the frontal and dorsal attachments to C1, C2 and C3. Torquing of the dura can cause scoliosis, cervical hypolordosis, thoracic hyperkyphosis, excessive lumbar lordosis , rotation of the pelvis causing uneven leg length, uneven shoulder height, etc. It also aids in creating head tilt through the dura's attachment around the foramen magnum. The cranial bones, because of their multiple attachments to the dura can also be malpostured through this torquing stress of the dura mater (Fonder 1988).

Also of interest are the neural connections between jaw and spinal mechanics.

When the teeth occlude, periodontal afferents (pressure receptors in the bone supporting the teeth) feed information to the main sensory Spinal tract and mesencephalic nucleus of the Trigeminal nerve (the largest of the 12 paired cranial nerves). Communication then occurs in the fore/mid-brain, brainstem and with the spinal nerves. So in essence the ways the jaws come together directly influences the spinal system and thereby posture and muscular alignment.

By way of illustrating this relationship a study by D'Attilio et al (2005) found that by introducing a deliberate interference into the dental occlusion of a rat produced a disturbing disruption of whole body posture, as confirmed by x-ray, and that later removal of this interference resulted in normalisation of the spine (D'Attilio et al 2005) this does make one wonder, as clinicians, how many times have we unwittingly caused or contributed to mandibular torque and the resultant sequelae. The previous experiment can be explained by the torque created by the artificially created stressful malocclusion of the teeth and resultant imbalance of the powerful masticatory complex of muscles, with a reciprocal imbalance of the infra-mandibular complex of neck and /shoulder musculature.(In the human 136 muscles are responsible for mandibular positioning)

This disturbs the postural relationships of the structures of the head, neck, shoulders, spine and pelvis (Whatmore 1974), creating a powerful and dominant condition that constantly produces physiological distress until a physiologically balanced maxillomandibular (jaw) relationship is achieved. It is very important to treat the jaw relationship first as it has been shown that teeth are the dominant force (i.e. we must bring the teeth together to feed and swallow), the muscles and joints will accomodate and posturally compensate in a potentially deleterious manner to allow this to occur. When these 136 muscles are allowed to assume a more physiologically balanced relationship by the correcting of the malocclusion, the head assumes an upright posture, the shoulders level off, the pelvic rotation ceases allowing the leg length to equalise, and overall bodily posture dramatically normalises (Fonder 1986). This was further supported by Sakaguchi et al (2007) when they showed via a series of tests involving use of a heel lift that changing mandibular position affected body posture.

In 2008 Bergamini et al similarly discovered the influence of a neuromuscularly balanced jaw relationship on groups of paired muscles. Surface EMG readings showed that when the jaw relationship was neuromuscularly balanced, resting muscle voltage was significantly reduced and paired muscle alignment improved for sternocleidomastoids, erector spinae, and soleus (calf) muscles - again showing how jaw relationships can affect whole body mechanics as distant from the occlusion as the calves. Amazingly the changes artifically created in the rat study by D'Attilio regularly occur to many of us, subclinically, from an early age from such causes as tooth extraction, teeth fillings/crowns, previous orthodontic work, adenoid/tonsil problems as children, trauma, environmental allergies, and can be seen via symptoms such as headache, clicking jaw joints, muscular tenderness, neck/shoulder pain, ear congestion/ringing, tingling fingers/hands, postural complications etc.

The CranioMandibularSacral system (CMS)

Dentistry, the craniosacral system, and functional systems of the body are profoundly intertwined in an 'elegant ecology.' To present a discussion of one without discussing the other's influences would be an artificial separation of these topics. Any change in dental anatomy and mechanics will have a significant influence on the craniosacral system and other functional systems in the body.

This 'elegant ecology' exists throughout the body, affecting anatomy and function. Its influence is so extensive that it is difficult to imagine any part of the body that is not affected. Let us look at some of these relationships:

The sphenoid bone is considered the central bone of the craniosacral system. Because of its unique and complex anatomy, it articulates with almost every other bone in the cranium. We can imagine the sphenoid being like a central cog in a wristwatch. If that central cog is out of balance, we would imagine that it can effect the balance of all of the other cogs in the watch, or in this case, all of the other cranial bones in the head.

Located directly on the sphenoid is the pituitary gland. It sits on the sphenoid in a formation that looks like a 'Turkish saddle.' In fact, the Latin name for that structure is called the 'sellae tursica.' The pituitary exerts profound influence over the endocrine system and, as such, directly influences the body's physiology and health. If the sphenoid is out of position ('lesioned') due to misalignment of the hard palate, pituitary function will suffer, and the body's physiological systems will be affected. The pituitary depends on the normal alignment of the cranial bones for its proper functioning.

A 'faulted' or 'lesioned' sphenoid caused by misaligned dental anatomy can result in a myriad of physiological, and neurological symptoms. It can be seen in patients with a deep overbite or malocclusion that body chemistry, blood and endocrine balance is affected (Shield 1998). Our aim therefore has to be to normalise and re-align the dental anatomy and effect positive feedback systems to improve overall muscular function, posture, alignment and health.

References

Bergamini M, Pierleoni F, Gizdulich A, Bergamini C. Dental occlusion and body posture: a surface EMG study. J Craniomand Prac 2008 Jan; 26(1): 25-32

D'Attilio M, Filippi MR, Femminella B, Festa F, Tecco S.: The Influence of an Experimentally-Induced Malocclusion on Vertebral Alignment in Rats: A Controlled Pilot Study, Journal of Craniomandibular Practice, April 2005, Vol 23, 119-129

Dunn, G.F, Green, L.J., Cunat, J.J. Relationships between variation of Mandibular Morphology and variation of Oesophageal Airway size in Monozygomatic Twins. Angle Orthod, 43:129-35. 1973

Fonder, A.C.: The Dental Distress Syndrome (Part One), 2nd Internat. Symposium on the Management of Stress, Monte Carlo, Monaco, Nov. 18-22, 1979. Stress, Vol. 1, No. 1, Hans Selye, Found., Spring, 1980.

Fonder, A.C.: The Dental Distress Syndrome (Quantified), Quantum Medicine, Vol. 1, No. 1, 1988.

Fonder, A.C.: TMJ Simplified (3 day courses), Rock Falls, IL. 1986-1987.

Gray, Henry L.: Anatomy of the Human Body. Edited by W.L. Lewis, pp 891-893, Lea and Fiebiger, Philadelphia, 1943.

Guzay, C.M.: Efficiency in occlusal function, Basal Facts: pp228-246, 1985

Guzay, C.M.: the Quadrant Theorem. Pub. by Doctors Dental Service, Chicago, 1980

Linder-Aronson, op.cit., pp.121-147, 1979

Linder-Aronson.S. Effects of Adenoidectomy on the Dentition and Facial Skeleton over a period of 5 years. Transactions of the Third International Orthodontic Congress, C.V.Mosby, St.Louis,1975.pp85-110

Maehara, K.: Matsui, T., and Takada, F: Dental Distress Syndrome (DDS) and Quadrant Theorim - The Masticatory System, General Signs and Symptomatoloty, Internat. J. of Biologic Stress & Disease: Basal Facts, pp 4-11, Vol. 5, No. 1, 1982.

Meredith, HV Growth of Head Width during the first Twelve years of life. Pediatrics 12:411-429, 1953

Sakaguchi K et al :Examination of the relationship between mandibular position and body posture. J Craniomand Prac 2007 Oct; 25(4): 237-49

Schreiner, C, op.cit.Dec.18,1996

Shield, M. Ph.D. The Symbiotic Partnership of Dentistry And Craniosacral Therapy (Parts 1&2)

Smith, Gerald: Cranial, Dental, Sacral Complex. Pub. by Internat. Nutrition Research Ctr., Newtown, PA, p.25, 1983.

Storberg, op. cit.

Thomas N. LVI Visions Publication Jan 2009 60-70

Whatmore, G.B. and Kohli, D.R.: The Physiopathology and Treatment of Functional Disorders. New York – London, Grune and Stratton, 1974