

## **DENTAL OCCLUSION AND ITS EFFECT ON STRUCTURE AND THE BRAIN**

By: Ara Elmajian, D.D.S.

The following article aims to clarify the effect of dental occlusion (relationship of the maxilla to the mandible) and its direct and indirect biomechanical interaction with the cranium, cervical spine, thoracic cage, pelvis and the feet.

Dental occlusion plays an extremely important role in the kinetic chain that determines the postural system. Chronic dysfunction of occlusion affects the central nervous system and health in general. The stability and proper function of the occlusal structure is determined by the balance between the tensional and compressive forces on the hard and soft tissue of the maxilla, mandible, head, neck and shoulders. The balance between the counteracting forces of tension and compression is called "tensegrity." In living organisms the continuous tension between its parts creates awareness of posture. This is referred to as proprioception and tensegrity drives proprioception. Tensegrity causes a change of tension in one part of the structure that produces a chain reaction of changes throughout the structure. The principles of tensegrity apply at the molecular level with the interaction of amino acids, cells, fatty acids, and proteins as well as at the skeletal level involving bones, ligaments, muscles, and tendons.

By recognizing and understanding the genetic and environmental background of different facial types and cranial divergences of individuals, we can use appropriate functional orthopaedic devices in a growing child to ensure optimal functional occlusion is achieved. Proper occlusion in turn will positively affect the biomechanical function of joints, which in turn will create correct posture, equilibrium, gait and normal reflexes.

Over the past several decades due to human intervention in environment, food quality and dental treatments (both preventative and invasive), dental structure has been affected. This in turn has affected the Righting reflex. The Righting reflex is primordial. It enables an animal to maintain its body in a definite relationship to its head by keeping the eyes focused on the horizon. This Righting reflex in turn preserves balance and equilibrium. It is for this reason that the Righting reflex is a primary mechanism for survival. A distorted maxilla with a pitch, roll or yaw will influence the entire cranial mechanism. This maxilla will also affect the visual field. The central nervous system via cranial nerve XI (accessory) sends signals to contract the trapezius or sternocleidomastoid muscles to correct the head position in order to keep the eyes focused on the horizon. Extended periods of incorrect posture will create musculoskeletal pathologies such as nerve entrapment, trigger points in the musculature and uneven wear of the dentition. The distortion of the head whether it is pitch, roll, or yaw or a combination of these, will alter the level of the shoulders, which in turn will change the level of the hips and finally will affect leg length and stride. The neck and thoracic cage positions will also be indirectly influenced, which introduces a host of neurological and structural symptoms.

Primary proprioceptive areas in the body are C1, atlas / occiput, TMJ capsule, head of first rib, sacroiliac joint and subtalar joint. The proprioceptive system is designed to keep the head, shoulders and pelvis level. Whenever there is distortion, the nervous system sends signals to the musculature to contract in order to correct the alignment of the skeletal system. This in turn can

cause such problems as Achilles tendonitis, lordosis, mandibular shifts, rotated pelvis, scoliosis, and sciatic lesions to name a few.

The vertical dimension (height of the bite) of the dental occlusion and the anterior posterior location of the mandible have a direct effect on head posture. A loss in vertical dimension forces the position of the head forward in relation to the coronal plane, which creates a lordotic neck and kyphotic thoracic spine, thus creating pain in the cervical spine, the low back and the coccyx region. The location of the pain is also related to the foot structure. A person with high arches who walks on the balls of their feet will experience pain in the lower back, usually towards the coccyx. A person with a retruded mandible due to malocclusion accompanied by a loss of vertical dimension will encounter cervical pain, upper thoracic pain and or upper lumbar pain. If this same person has feet with flat arches causing them to balance on their heels, then the back pain will most likely be experienced in the upper lumbar region. There are many possible scenarios of pain as a result of the relationship between dental arch development and the arch of the foot. In addition to dental arch and foot arch evaluation, the genetic makeup of a person needs also to be considered. It should be mentioned that repetitive activity due to sports and other activities obviously have an effect on the foot arch development. It is also notable that different activities, such as ballet, horseback riding, running, skating, etc., not only affect the structure differently but also cause pain to be manifest in a different area of the spine. Therefore, it is crucial when addressing neck, back and pelvic pain, to consider both the dental arch and the arch of the foot in the diagnosis and the treatment.

The relationship between dental occlusion and the cranial sacral mechanism is well known and understood in the field of osteopathy, specifically the correlation of the maxilla to the sphenoid bone and the mandible to the temporal and the occipital bones. In a situation where there is a dental malocclusion, the cranial lesion cannot be corrected or stabilized until the maxilla and mandible are properly aligned. For example, in a left side bend situation the mandible is driven back and to the left while the maxilla is rotated downwards and to the right. A loss of vertical dimension on the left side is seen and the head tilts to the left. In a child the tongue rests between the left molars for support and the right central incisor over erupts. This particular cranial lesion will be corrected only with proper orthopaedic / orthodontic treatment. The occlusal scheme, the vertical dimension and the anterior posterior relationship of the maxilla to the mandible all strongly influence the articular mobility of the cranial bones. This in turn affects the fluctuation of the cerebrospinal fluid and the mobility of the intracranial and intraspinal membranes. Osteopathic principles are based on proper distribution of the cerebrospinal fluid, which acts as a carrier of nourishment that is vital to the central nervous system's metabolism.

In addition to the structural distortions, the swallowing mechanism also has to adapt for survival. Deviant swallow patterns will develop in all types of structural misalignments. The tongue and lips engage in a disharmonious fashion to create the seal in order for swallowing to occur. A repetitive deviant swallow and seal will create further problems of dyskinesia. Speech impediments can also develop leading to psychological complications.

It has been shown in animal studies that occlusal dysfunction produces profound changes in autonomic, motor, and postural functions. A comprehensive paper published in Japan by Teruaki Sumioka, under the supervision of Dr. Kiyoshi Maehara of the Department of Dental Pharmacology has clearly illustrated this. By changing the vertical dimension on one side of a

dog's occlusion, considerable systemic motor dysfunctions were created as well as postural and autonomic abnormalities. This paper, with its multiple references, concluded that the trigeminal nuclear complex has connections to the basal ganglia, the cerebellum, the vestibular nuclei, the brain stem reticular formation and the superior colliculus. This study also demonstrated a close relationship between the trigeminal spinal nucleus and the amygdala, which is considered to be closely associated with autonomic function.

It is evident that the topic of dental structural influence on the central nervous system and body functions is a complex multifaceted process that could be the subject matter of a complete textbook itself. The purpose of this brief outline was to illustrate and clarify the complexity of appropriate dental / cranial management.