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Review Articles

The Relationship Between Dental Occlusion/Temporomandibular Joint Status and General Body Health: Part 1. Dental Occlusion and TMJ Status Exert an Influence on General Body Health

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Abstract

Background: There have been varied studies that have suggested a relationship between dental occlusion/temporomandibular joint (TMJ) status and general body health. Therefore, it is important to elucidate the systematic relationships and corresponding action mechanisms between them.
Objectives: The purpose of this part of study was to review the relationships between dental occlusion/TMJ status and systemic body health based on the published literature.
Methods: This study, based mostly on peer-reviewed specialist articles, has determined that dental occlusion/TMJ status exerts an influence on (1) synchronization of head and jaw muscles with the muscles from other body sites for proper body posture; (2) body stability such as body equilibrium (balance), center of gravity fluctuation, and gaze stability; and (3) physical performance along with physical fitness.
Conclusions: Therefore, these relationships should be further investigated and extended to the whole body, and the action mechanisms should be elucidated.

Introduction

The authors have treated the symptoms originating from the disorders in temporomandibular joint (TMJ) and occlusion for a number of years. During the course of these treatments, it was found that restoring the dental occlusion and TMJ status to their normal or natural condition resulted in a change in general body health, in most circumstances better than before. The general conditions that improved, as reported by the patients, included body posture such as left and right equilibrium, back pain, hyperhydrosis, hand tremor, gaze stabilization, gag reflex, blurred vision, and headache. Therefore, a connection was conjectured between dental occlusion/TMJ status and general body health based on clinical findings and related reports.[1–5] Such a connection might be anatomical or related to various body systems, and certain of these connections have been reportedly observed in Western medicine–based investigations.[1–8] However, the mechanism of the healing effect after occlusal or TMJ treatments on general body health still is not clear. These connections and corresponding healing might play an important role in complementary and alternative medicine (CAM).

CAM comprises a group of diverse medical and health care systems, practices, and products. CAM treatments include whole-body treatment, mind–body medicine, biologically based practices, body manipulation, and other therapeutic and vitality-stimulating practices.[9] CAM of late has attracted interest in the dental field.[10,11] However, the term integrative medicine in the dental field,[9] in short, integrative dentistry, would most likely be a better term for the explanation of the connections between dental occlusion/TMJ and other parts of the body. Integrative medicine combines treatments from both of Western and alternative medicine for which there is a substantial body of high-quality evidence for effectiveness.

There have been studies conducted on the relationships between dental occlusion/TMJ and general body health. Alterations of the manducatory system, resulting from lesions in the masticatory muscles or dentoalveolar ligaments, can

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perturb visual stability and thus generate postural imbalance.[1] The position and functioning of the mandible affect the center of gravity.[2,3] Dental occlusion has been shown to be associated with reduced lower extremity dynamic strength, agility and balance in elderly people.[4] The proper functional occlusion of natural or artificial teeth has been shown to play an important role in generating an adequate posture reflex through mandibular stability, thereby preventing falls.[5] Therefore, it is necessary to elucidate the systematic relationships and corresponding action mechanisms between dental occlusion/TMJ status and general body health.

In this series of reviews (parts 1 and 2), the relationships between dental occlusion/TMJ status and general body health are scrutinized, based mostly on peer-reviewed articles, and a conceptual theory that can explain this healing mechanism is proposed. In part 1, basic concepts related to dental occlusion from the viewpoint of integrative dentistry are introduced, and articles dealing the relationships between them are investigated. In part 2, a conceptual theory to explain the relationships between them is proposed from the viewpoint of fascial connection.[7] A fascia is a connective tissue that surrounds muscles, groups of muscles, blood vessels and nerves, binding those structures together like plastic sandwich wraps.[8] It consists of several layers: a superficial fascia, a deep fascia, and a subserous (or visceral) fascia and extends uninterrupted from the head to the tip of the toes. Since the fascial connection through the whole body has already been introduced,[6] the focus of the present study was to emphasize the importance of TMJ and dental occlusion for the building up and maintenance of general body health through fascial connections. Future studies regarding the psychologic and emotional factors and CAM factors such as *qi* and the meridian system, cerebrospinal fluid, and other disciplines for these connections might be followed additionally.

The purpose of this part of the study was to review the relationships between the dental occlusion/TMJ status and general (systemic) body health based on specialist literature.

Occlusion, TMJ, and TMJ Disorder

Occlusion

The meaning of "dental occlusion" is simply the contact between the teeth. It is the relationship between the maxillary and mandibular teeth when they approach coming into contact with each other, as occurs during chewing or at rest.[12] The TMJ is the joint of the jaw. The name is derived from the two bones that form the joint: the upper temporal bone and the mandible. The unique feature of TMJ is that this joint is the only bilateral joint that crosses the midline.[13] One can move any right-sided joint such as arm, leg, hip, and so on without the moving the left corresponding joint. However, one cannot move the right TMJ without moving the left TMJ, which has many implications in fascial connections, neuroanatomy, and neurophysiologic effects of the TMJ.

It is suggested that there are five requirements for the ideal organic occlusion in gnathology,[14] such as a centric jaw relation, immediate front teeth separation, proper cusp–fossa relationship, stable/even bite, and proper space (volume) inside the mouth. Organic occlusion is an arrangement of the teeth such that they properly fit into the oral space without violating group uses of the teeth, length of the chewing muscles, interocclusal space, rest position, and condylar control.

The treatments of dental diseases seek to bring about a condition of harmony within the entire stomatognathic system. In this sense, teeth are a set of gears anchored in bone, and the upper and lower jaws are attached to each other by the TMJ.[14] Powerful muscles guide and direct the movement of the lower jaw, allowing the teeth to carry out their functions of chewing and speaking. If the TMJ and teeth are not in synchrony, the masticatory muscles over time can literally destroy an otherwise healthy dentition.[14,15]

TMJ and TMJ disorders

According to the National Institute of Dental and Craniofacial Research,[16] there are several types of TMJ disorder: (1) myofascial pain is the most common, which is characterized by discomfort or pain in the muscle that controls the jaw as well as the neck and shoulder muscles; (2) internal derangement of the joint; and (3) degenerative joint disease. Myofascial pain, referred from hyperalgesic trigger points located in skeletal muscle and its associated fascia, is a common cause of persistent regional pain.[17] A myofascial component is frequently considered part of these pain syndromes that involve TMJ. TMJ dysfunction caused by myofascial disorders with trigger points in masticatory muscles is variously referred to as oromandibular dysfunction, myofascial pain-dysfunction syndrome, the TMJ pain dysfunction syndrome, or craniomandibular dysfunction. Trigger points in masticatory muscles are presumably caused by malocclusion, misalignment of the jaws, habitual parafunction of the jaws (clenching, bruxism, and jaw posturing), abnormal head and neck postures, or trauma.[17]

Pinpointing the specific causes for a given TMJ disorder can prove difficult, due to the following reasons: (1) patients often have more than one problem; (2) jaw pain can be referred from other areas, such as problems in the sinuses or dental conditions; and (3) TMJ symptoms can result from a systemic problem such as fibromyalgia, rheumatoid arthritis, lupus, and so on.[18] The originating causes of the TMJ disorders can be categorized into the five groups such as dental, injury, habit, stressful social situation, and emotional factors.[18] Regarding the causes of TMJ disorders by injury, whiplash, traction appliances, and blows to the head, face, or jaw have been proposed.[18] TMJ disorders are known to be a possible sequela of motor vehicle accidents, particularly when flexion–extension injury occurs. The literature related to motor vehicle accidents, whiplash injury, and TMJ dysfunction was reviewed.[19] An analysis of the forces resulting from these rear-end (whiplash) motor vehicle accidents indicates that tensile, compressive, and shear forces occur that challenge the integrity of the soft tissues of the TMJ.[20] Evidence of significant injury to the TMJ, ear, and ophthalmic system has been also found following a soft-tissue hyperextension injury of the cervical spine.[21]

Regarding causes of TMJ disorder by habits, bad posture, bad ergonomic habits at work, oral habits such as pencil biting, gum chewing or clenching, childhood habits such as thumb sucking, and poor diet and strenuous activities such as heavy lifting that strain the neck or the back have been cited.[18] During a parafunctional swallowing, the oral seal is achieved by contracting the obicularis and buccinator muscles against the tongue, which results in obvious hypertrophy of the relevant muscles. Depending on the severity of

this habit, the teeth may be sucked lingually, often causing the crossbites associated with TMJ disorder.[22]

Since the TMJ lies in close proximity to the brain, ears, eyes, and balancing system, the seating of the mandible in the mandibular fossa is of considerably greater importance than is often appreciated. Dizzy spells, ringing in the ears, headaches, pains, and noises in the head may all be related to poor condyle posture in the joint.[14] These symptoms also include the blurring of vision, otalgia, tinnitus, hyperacusis, aerotitis media, deafness, staggering gait, vertigo, dizziness, nausea, vomiting, abdominal pain, blackouts, and even loss of consciousness.[23]

Relationship Between Occlusion/TMJ and General Body Health

The subgroups of general body conditions correlated with dental occlusion/TMJ may be divided into three parts: (1) synchronization of the head and jaw muscles with muscles at other parts for the purpose of proper body posture; (2) body balance (equilibrium); and (3) physical performance. All of the following reports support the notion that there are systematic relationships between dental occlusion/TMJ and general body health.

Synchronization of the head and jaw muscles with muscles at other parts of the body

Electromyographic studies show that patients with TMJ disorder often have abnormal patterns of muscle activity.[24] The functional coupling of the stomatognathic system with the neck muscles is well known. Patients suffering from occlusal or TMJ disorders frequently report dysfunction and pain in their neck muscles.[25,26] Among the neck muscles, the role of the sternocleidomastoid muscle is to maintain and change the posture of the head. The activity of the sternocleidomastoid muscle is synchronized with the jaw-closing muscles in both mastication and involuntary clenching.[27] Tenderness of the sternocleidomastoid muscle is often found in patients with TMJ disorders, and pain in the region of the sternocleidomastoid muscle was improved by occlusal treatments.[28–30] An imbalance of the sternocleidomastoid muscle activity, leading to neck pain, can be induced by a unilateral loss of occlusal support.[2] These findings suggest a systematic relationship between occlusal status and the sternocleidomastoid muscle.

Traumatic minor cervical strains are commonplace in high-impact sports, and premature degenerative changes have been documented in sports players exposed to recurrent impact trauma or repetitive forces. It is evident that impairments in position sense are observed in individuals who have experienced whiplash-type injuries and individuals with chronic head and neck pain of nontraumatic origin such as cervical spondylosis.[31] The biomechanical influences of head posture on the cervical column and craniofacial complex during masticatory simulation were quantified using three-dimensional finite-element analysis.[32] Results showed that alteration of head posture was directly related to stress distribution on the cervical column, but may not always directly influence the occlusal state. The influence of altered neck muscle function on the morphology of the craniocervical area was studied in the rat. The findings are indicative of postnatal functional adaptation of periosteally mediated bone morphogenesis in the craniocervical area.[33] The biomechanical effects on cervical vertebral columns during mastication were calculated, which confirmed that vertical occlusal alteration could influence stress distribution in the cervical columns.[34] Lateral inclination of the occlusal plane and imbalance between the right and left masticatory muscles antagonistically act on displacement of the cervical spine (i.e., the morphological and functional characteristics in patients with mandibular lateral displacement may play a compensatory role in posture control).[35] Possible associations between trunk and cervical asymmetry and facial symmetry were reported.[36] It was found that frontal head position in relation to the true vertical is stable in that the angle between the supraorbital and vertical lines is constantly maintained close to 90° regardless of moderate trunk asymmetry, indicating that visual perception control is most important in orienting the head in the frontal plane.[36]

A relationship between dental occlusion and posture control has been postulated,[37,38] and it was subsequently confirmed that there is a close relationship between occlusal support and head posture.[2] The influences of head and body posture on the mandibular rest position, range of functional movements, and initial tooth contact were documented.[39] Clinical studies showed that the jaw and neck muscles work together in a relatively stereotypical fashion during rhythmic movements.[40,41] These studies suggest that orofacial sensory information, especially the periodontal input, modifies neck muscle activity, which is thought to be an important neural substrate for the coordination of masticatory function.[42] The effects of the specific modalities of sensory inputs to the teeth on the motor activity of neck muscles were tested, and it was suggested that periodontal inputs play an important role in controlling neck muscle motor activity.[43]

The relationships between orthopedic findings such as unequal leg length, pelvic obliquity, columnar diseases and head posture, and dental findings such as occlusion, mandibular position, TMJ and masticatory muscles were reviewed.[44] As a result, most of the publications lacked good evidence, although there has been an expression of great interest in the possible relationships between orthopedic and dental findings. The hypothesis that there is a relationship between the TMJ, osteoarthritis/osteoarthrosis, head posture, and dentofacial morphology was tested and the results did suggest an association among all of them.[45]

In summary, it can be concluded that there is a necessary systematic synchronization of the head and jaw muscles with the muscles of other parts of the body to maintain proper body posture.

Dental occlusion/TMJ and body stability

Body equilibrium (balance), center of body gravity fluctuation, and gaze stabilization have been utilized as assessment criteria to determine the influence of occlusion/TMJ on the stability of the body. At the outset, basic information regarding body stabilization needs to be briefly considered. Human beings assume a relatively unstable postural state when in the standing position, because the supporting plantar area is narrow; therefore, the maintenance of standing position is related to the center of gravity fluctuation, a phenomenon that is said to be controlled by information from the ocular region, three semicircular canals, and antigravity muscles.[46,47] In addition, the center of gravity is

positioned at a high point in the human being, because the heavy skull is located at the highest point of the vertebral column,[48] which makes balancing difficult. Complex nervous interactions regulate the function of oculocephalic synergetic centers, which can help in maintaining a proper masseter muscle tone in order to maintain the mandibular axis in the correct position.[49]

In addition to these findings, it has been suggested that occlusion and head position affect the center of gravity, resulting in an increased risk of falling.[50,51] When individuals are in an upright position, continuous oscillations are generated to maintain balance. Sensorial afferents are provided from proprioceptive, tactile, vestibular, and visual receptors. Proprioception of the mandibular system arises from the masticatory muscular system and dentoalveolar ligaments. Therefore, poor or absent dental occlusion may decrease proprioception in this area, interfering with the proper stability of the head posture.[1] Head movements may be related to orofacial functioning, which is predominantly controlled by somatosensory inputs from the orofacial area.[43] Proprioception of the mandibular system has a great effect on postural control,[52] and postural control is significantly impaired after unilateral conduction anesthesia of the mandibular nerve.

It is thought that tooth loss is a risk factor for postural instability, and that the incisors and molars play different roles.[53,54] Physiologically, mechanical receptors in the periodontal membrane control mandibular movements and coordinate the masticatory function,[55,56] and this is related to the motor activity of neck muscles.[43] These further suggest that proprioceptive sensation from the periodontal ligament receptor plays a role in body balance control.[54]

Modifications of the position of the center of foot pressure during normal standing caused by the occlusal condition were investigated.[39] Poor or inadequate dental occlusion might be a predisposing factor for falls in older people, and improving occlusion deserves attention as an approach to the prevention of falling in elderly patients.[5] A relationship between dental occlusion and fallings among the elderly with dementia has also been demonstrated.[5,57] These findings show that elderly individuals who lack proper dental occlusion are at a higher risk of falling than those whose dental occlusion has been maintained. Therefore, it was suggested that a dental examination should be included in the standard health examination for elderly persons, especially those with symptoms of dementia.[5]

The center of gravity fluctuation caused by experimentally altering the occlusal contact area was examined, which confirmed that occlusal contact affected gravity fluctuation, and that appropriate occlusion attained by maintaining even occlusal contact in the posterior region was crucial for gravity fluctuation.[58] The repercussions of dental occlusion upon postural and gaze stabilization were examined, and it was concluded that postural control and the quality of gaze were best at the centric relation occlusal position, which is explained by the optimal symmetry achieved in this position.[1]

In summary, it was can be concluded that dental occlusion/TMJ condition exerted an important influence on body stability.

Dental occlusion/TMJ and physical performance

Muscle activity, physical fitness, and motor performance have been used as assessment criteria to determine the influence of occlusion/TMJ on the physical performance of the body. Empirically, coaches advise sports players to wear occlusal splints or mouthguards during competitions in order to increase motor performance in such sports as baseball,[59] long distance running,[60] and football.[61] It was also reported that proper teeth clenching plays an effective role in the enhancement of sports performance.[62] Improvement in postural control under the centric relation occlusion resulted in superior shooting performance in shooters.[1] The centric relation occlusion is the mandibular position in which the head of the condyle is situated as far superior and anterior as it possibly can within the mandibular fossa.

The relationships between dental occlusal status and physical fitness in elderly adults were investigated, and it was reported that leg extensor power, stepping rate, and one-leg standing time were useful indicators for evaluating lower extremity dynamic strength, agility, and balance function, respectively.[4] The relationship between the presence of occlusal support in edentulous subjects and their capacity for physical exercise was investigated, and it was concluded that reconstruction of occlusal support at a desirable mandibular position had significance not only for the restoration of masticatory function but also for the maintenance of physical exercise.[63]

In summary, it can be concluded that dental occlusion/TMJ condition influenced physical performance.

Conclusions

Based on the specialist literature, dental occlusion/TMJ status influenced systemic body activities such as synchronization of the head and jaw muscles with other parts of muscles to achieve proper body posture, body-stabilizing activities such as body equilibrium, gravity fluctuation and gaze stability, and physical performance such as muscle activity, physical fitness, and motor performance. Therefore, the action mechanism for these evident relationships should be further investigated. Furthermore, in addition to Western medicine–based references, therapeutic practices from the viewpoint of CAM should be further investigated in order to set up an approach of integrative dentistry for the TMJ.

Disclosure Statement

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