

Chapter 17

Understanding Posturo–Occlusal Interrelationships by Combining Digital Occlusal and Posture Diagnostic Technologies

Patrick Girouard, DMD MS
Acadia University, Canada

ABSTRACT

The nature of the interrelationship between whole body posture and the quality of the dental occlusion has not yet to date been clearly documented within the dental or posture literature, as the findings of published studies within both fields have been scarce and inconclusive. The combined use of digital diagnostic occlusal and postural assessment technologies has not been widely employed in these research projects, which has mired both fields' ability to study, to understand, and to clearly ascertain how posture and dental occlusion affect each other physiologically. As such, the specific aims of this chapter are to outline how posture and dental occlusion interrelate through the stomatognathic system's afferent neural inputs into the central nervous system (CNS), which communicate important occlusal contact force distribution information, and equally as important, mandibular spatial positional information within the posture and balance regions of the brain. The concept that the dental occlusion is a capteur for posture (which in English means, a sensor of posture health), is further explored with the inclusion of three differing clinical posturo-occlusal cases, diagnosed and treated with the combined use of the T-Scan 9 computerized occlusal analysis technology, the MatScan/MobileMat foot pressure mapping technology, and the Footmat Research software version 7.10. These presented clinical cases illustrate that improved right-to-left occlusal contact force balance, and improved center of force location within the dental arches, improve a number of measurable sway parameters. Together, the implementation of the T-Scan and the MatScan exquisitely demonstrate to the clinician the significance of the physiologic interrelationship between body posture and the dental occlusion. The presented cases emphasize there exists a whole-body concept that depends upon a variety of differing systems, whereby changes in the dental occlusion produce a phenomenon of bio-functional neuro-reprogramming for the stomatognathic system and the whole body.

DOI: 10.4018/978-1-5225-9254-9.ch017

INTRODUCTION

Posture

The distinctive characteristics that differentiate man from the apes in its history of evolution, was bipedalism, or standing on two feet. It was confirmed with the discovery in 1925 by Raymond Dart, of a primitive child's skull known today as the Taung Child. This skull had a distinctive feature that differentiated it from apes' skulls, the foramen magnum through which the spinal cord travels, was further forward than in an ape, indicating that the head was erect, and the creature stood upright. This was known as the discovery of *Australopithecus africanus* (Simons, 1989).

Morphological features are intimately related to biomechanics, "in particular by causal morphogenesis ('Wolff's law') and by the interplay of mutations and selection (Darwin's 'survival of the fittest')". Every skeletal component must endure the loads to which it is subjected. The most demanding ones occur during postural and locomotion tasks, to counteract the forces of body weight. In the skull, however, the greatest loads arise during biting and chewing (Preuschoft, 2004). In a study of young adults, a variation of the magnitude of the bite-force resultants ranged from 246.9 to 2091.9 N, with a median of 776.7N (Hattori et al., 2009).

A bipedal posture does not represent a stable biomechanical posture. The challenge to the balance control system is that two-thirds of the body mass and two-thirds of body height are located at the top of the legs well above the ground. This promotes instability that requires constant adjustments of the postural system to maintain a stance (Winter, 1995).

The definition of posture is:

- The positions of the body segments relative to gravity

The definition of stability is:

- The ability to control the displacement of the Center-of-Gravity (COG) while standing.

A greater stability is generally associated with smaller amplitudes and velocities of the COG displacement (Danis, Krebs, Gill-Body, & Sahrman, 1998).

Autoregulation reflexes provide the balance control from sensory inputs coming from the eyes, ears, muscles, and joints relative to the environment. The processing of this inputted information depends on the brain and the brainstem, whereby the majority of neuromusculoskeletal disorders arise from degeneration in the balance control system. The adaptability of the Central Nervous System (CNS) may mask a pathology until the compensation system ceases to make up for a loss of function (Byl, 1992).

The CNS operates balance control through the synergetic activation of muscles at specific joints, based on its organization of the sensory afferences from visual, somatosensory and vestibular inputs. Noteworthy, is that the response latency to a balance perturbation is different and slower than from visual cues (200 msc), when compared to the faster somatosensory response (80 - 100 msc) (Samuel, Solomon, & Mohan, 2015).

The maintenance of the body stance is under multisensory control. When the eyes are closed, this control recruits kinesthetic and vestibular information relative to gravity, in order to maintain the vertical orientation of the body (Hlavačka, 2003).

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