Preface

According to the traditional orthodontic view the sensory and motor functions of the mouth are considered as phenomena coded in the DNA molecule of the neuron, and this coding acts as a template, a blueprint or a program, containing all the necessary information for normal oral behavior development, with the corollary that evident oral functional disorders, such as seen in certain malocclusions of the teeth are interpreted as DNA coding errors, as mistakes in some inborn or congenital programs [1, 206].

Contrary to this traditional teaching, however, we now know that sensory experiences can modify the structure and function of the brain or structures within it. In other words, the brain is structured by the senses, through patterned sensory input, along with the many different kinds of chemical molecules produced in the brain, such as neurotransmitters, growth factors, and trophic factors. These chemicals mediate the transmission of information and the changes in the brain, control the growth and survival of neurons, as well as the formation of appropriate neural circuits for the communication between the neurons and processing of information in the cerebral cortex. The changes in the brain, in turn, underlie sensation–perception, motor behavior, mentation, and memory of new learned experiences.

The oral sensory experiences can influence these brain functions, through the disposition of the key chemical molecules, along with the generation of action potentials in the sensory axons innervating the oral sensory receptors, which convey the patterned information from the oral senses to the cerebral cortex for decoding and sensorimotor integration function, an obvious circumstance that is relevant to the development of normal oral motor behavior. Conversely, sensory deprivation of the cerebral cortex may affect learning of oral functions, such as speech and chewing, through the impairment of the brain's respective mechanisms.

The implications of these relatively new discoveries are profound. The life plan of a neuron is not in its genes. It is also experience-driven. Accordingly, the growth and function of the nervous system which forms the substrate of the oral sensorimotor functions is an epigenetic process, responding to environmental experiences. This means that the oral functions, such as speech, chewing, etc, do not progress from some innate functional oral abilities, but are new functions that need to be learned actively by the child through the sensory experiences. In fact Schanberg [73] demonstrated that environmental factors such as tactile stimulation can influence genes related to growth and development of the body, through endocrine factors. This is interesting because the first sensory input in life comes from the sense of touch and pressure while still in womb. Infants and children are dependent on touch stimulation for normal growth and development and for building their brain. During the first year of life everything the baby picks up goes into the mouth and is learned through the mouth's touching.

In these perspectives the neuromuscular disorders associated with malocclusions of the teeth may be regarded as brain dysfunctions affecting the mouth's functions. Orthodontic changes in the occlusion of teeth and of the maxillofacial skeleton may improve the abnormal oral functions through neuroplasticity, which in turn, may be incorporated into the rules that govern the structure and function of the oral sensory and motor maps in the postcentral gyrus and precentral gyrus of the cerebral cortex as the brain changes. This implies that orthodontic therapy can alter the sensorimotor behavior of the mouth, which is key to the soft and hard tissue anatomy of the mouth. This view is in contrast to the conventional orthodontic concepts, which attribute to orthodontic therapy changes a minor peripheral influence, confined mainly to dentoalveolar structures.

This book may help to set the scene for future explorations in this field, which may help to elucidate the abnormal oral motor behavior in malocclusions of the teeth, delving into the underlying brain mechanisms. Our challenge is to discover how oral experience builds the structure and function of the brain.

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