Including Functional Exercises in the Seventh Hour

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This article[1] highlights the four vegetative oral reflex functions – chewing, sucking, breathing and swallowing – as avenues of approach to the work of the Seventh Hour. An understanding of the movements, bones, joints, and muscles employed in these functions provides both a reference and an orientation to the structural work of the Seventh Hour. I also seek to bring a vision of bodily organization that enhances our sense of the involvement of these functions, and also to show that working functionally provides a resource preparatory to core opening, maintains the gains of the structural work, and allows us to organize the cervical and atlantooccipital regions – all of this besides reducing our clients' discomforts.

I will not explain the particulars of oral exercises, but will highlight what they can achieve. The information contained herein is from notes of classes conducted in 2006 and 2007, and from interviews with oral health specialists Beatriz Padovan and Carlos Douglas.

Introduction

To think about oral functions, we must go back to the origins of animal structural organization. Unlike plants, which developed photosynthesis as their means of nourishment, animals developed nervous systems, which brought the possibility of voluntary movement in pursuit of food. In other words, feeding is the motive of locomotion.

Following this idea, when we consider the dichotomy of form and function, we discover that each vertebrate animal has an axis, one extremity of which is the entry point for food, and the other of which is the exit point for that which the body does not assimilate. Therefore, the mouth, which is one extremity of the axis, is a reference not only for locomotion but also for vertebrate morphology generally. In fish, amphibians, reptiles, and quadrupeds, where the axis is aligned horizontally in relation to the center of gravity, we see the mouth in front with respect to locomotion. Thus, we have hind legs (or fins, in the case of fish) posterior to the axis to push the body forward (rear drive), and at the same time the mouth provides another force in the opposite direction (front drive). These forces combine to generate a sense of push-pull – a functional opposition shared throughout the vertebrate animal family. In humans, however, there are other possibilities; we can move to wherever our faces are directed.

Based on these facts, as well as other mechanical and neurological observations, oral health professionals such as orthodontists, phonoaudiologists, bucomaxillary specialists, and others have a vision of bodily organization based not on the support of the structure, as in Rolfing® Structural Integration, but rather on the reference point of the mouth (the stomatognathic system). This concept of bodily organization is important because it is the reference of many health professionals, including the followers of Sigmund Freud. In his theory of the development of psychic structures, Freud considered the "oral" stage to be the beginning of human psychic existence; at that stage, we begin to move and to perceive ourselves and the world through the mouth. Besides, this view of bodily organization enhances, reinforces and complements our own as Rolfers. The typology of the oral health professions is well known to us, as if they have arrived at the same place via a different route.

For me on my path, this idea greatly enhances comprehension of how the axis functions and the question of communication among the diaphragms. And, above all, it leads to a reassessment of the importance of the muscles of mastication, the temporomandibular joint (TMJ) and the tongue – all of which are explored but little in Rolfing [SI] – for proper posture and structural function. We should also keep in mind the importance of the study of function to the understanding of form, as well as its importance as a reference for structural work.

Views of 7th Hour Work

We come to the Seventh Hour with the objective of finding a position of equilibrium for the head. This is a daunting task, as we are seeking equilibrium over the vertebral column for the cranial mass, which weighs over five kilograms. For something this heavy, we seek equilibrium of the occiput

over the condyles of the atlas, which surround the dens of the axis. It is no accident that we have a veritable forest of muscles that connect, stabilize, extend, rotate and flex the head over the neck.

So, let's consider the mobility of the head. It is stimulated by the sense organs: the eyes, nose, mouth, ears, and skin. Embryologically, the mouth is the first of these organs to form. Once the entry point for food and the exit point for unassimilated byproducts forms the axis around which human structure is organized, we observe in the embryological development that the gastrulation of the morula forms the digestive tube, already rendering the mouth both the superior reference of the axis and the starting point for the embryological differentiation of the endoderm, ectoderm, and mesoderm. Shortly after the digestive tube is formed, nerve tissue starts to form at its inferior portion and migrate toward the mouth, where the central nervous system will develop.

In humans, motor control begins at the mouth through sucking. The very first voluntary human movement is to suck the thumb, which activity begins *in utero*, at the fourth month of gestation. This thumb sucking is timed to the mother's heartbeat and coordinates the function of the fetus' hyoid muscles, which the newborn will need in order to suck at the breast. Intrauterine thumb sucking also allows the fetus to ingest amniotic fluid, which contains substances necessary for the maturation of its digestive and respiratory tracts. Because thumb sucking has a formative function, all fetuses exhibit this behavior in utero.

We must also keep in mind the percentage of the motor homunculus devoted to the mouth: the mouth occupies 20% of the primary motor cortex. Let's list some of the mouth's functions:

- sucking, chewing, breathing, swallowing
- vocalization
- maintenance of mandibular position, which is a component of the upright posture that, if inhibited, will interfere with the upright posture
- yawning
- kissing
- biting
- whistling
- ejective behaviors, such as vomiting, choking, regurgitating, and belching
- blowing
- forming facial expressions
- smiling and laughing

So, we return to the question of proper placement of the head over the spinal column. We learn from the oral health profession that the position of the mandible determines the position of the head. The three main muscle groups governing mandibular position are:

- the muscles of mastication
- the suprahyoids (digastrics, stylohyoid, milohyoid, geniohyoid)
- the infrahyoids (sternohyoid, thyrohyoid, omohyoid)

These muscle groups effect a dynamic in which the muscles of mastication act as antagonists to the hyoid muscles. In the taxonomy of Tom Myers, the latter are part of the deep anterior line, which penetrates the thorax through the mediastinal fascia. Their participation in the deep anterior line makes them functional antagonists to the powerful muscles of mastication.

The muscles of mastication belong to the erector group. In other words, they are antigravity muscles, and are among the strongest in the entire body. No wonder, in an evolutionary sense, we see that in most non-human vertebrate species they are the principal mechanism of attack and defense.

Accordingly:

- If the tension in the muscles of mastication is greater than the tension in the hyoids, then the head will be displaced backward and the axis will be hyperextended posterior.
- If the tension in the muscles of mastication is less than the tension in the hyoids, then the head will be displaced forward and the axis will collapse forward.
- If the tension in the muscles of mastication is unequal from one side to the other, the axis will rotate.

Of course, as with any typology, we encounter various combinations in between the pure types. We must also remember that the position of the mandible is determined by genetics, by the positions of the teeth, and by the way the person performs the various oral functions.

The mandible is controlled by the TMJ, which is a very special joint. It is the only synovial joint of the face; it allows motion along three vectors; and is one of the most highly innervated joints in the body. As noted above, the TMJ receives proprioceptive signals regarding bodily positions and movements so that the position of the head may adjust appropriately. Because it is a paired joint, the TMJ also registers any difference in the horizontal level of one condyle from that of the other, and transmits this information to the brain so that the body may adapt to support the head. In addition to postural information, the TMJ registers periodontal information concerning the consistency of food, which indicates how much force is needed to chew it and when to stop chewing – or whether the food contains a bone or small stone harder than the teeth themselves.

But in my opinion, the most important point for structural integrators is the TMJ's intimate association with the thalamus gland, which is the center of the limbic system. The limbic system coordinates affects connected to the basic survival mechanism of "fight or flight." Whenever the sympathetic branch of the autonomic nervous system is activated, the trigeminal nerve is also activated to prepare the mandibular system for attack or defense.

Thus, the entire mandibular system (nerves, bone, muscles. and teeth) is activated involuntarily. As I see it, this is the principal justification for functional work with the four oral reflex functions (sucking, chewing, breathing, and swallowing): in our society, we are exposed to sympathetic activation many times each day, which powerfully reinforces existing neuromotor patterns affecting the cervical region, head and throat.

Working with the Four Oral Reflex Functions

All four oral reflex functions employ the same neuromuscular equipment. Because the functions are so interconnected, if we find a dysfunction in one, we may be sure to find altered function in the others, as well. For this reason, Padovan cautions against working with any one function in isolation from the others.

Chewing

Chewing combines mandibular movements in three dimensions – front-to-back, side-to-side, and top-to-bottom – resulting in a helical motion. This happens so that both sides of the array may work equally. Chewing begins with a bite, after which

the teeth chop and tear the food to the consistency of the alimentary bolus. At any moment, one side is working, and the other is poised to work. On the working side, the teeth are in contact with the food, while on the other side they are not, and there is space between the teeth. The two sides alternate their functions as the tongue transports the alimentary bolus from one side to the other. If for some reason one of the two sides works more than the other (unilateral mastication), over time the mandible will develop a rotational pattern resulting in a fixation in the direction of the harder-working side.

The main muscle group for chewing comprises the muscles of mastication: temporalis, medial and lateral pterygoids, and masseter. The initial bite is effected by the temporalis, masseter, and pterygoids. The masseter maintains the mandible in the closed position. The lateral pterygoid effects the side-to-side component of chewing.

These days, because our food is so soft, we chew ten times less than humans did at the start of the twentieth century. As we chew, we induce parasympathetic activation, and discharge and inhibit the activation of the trigeminal nerve. As the mandible alternates between opening and closing, the sides of the mouth alternate between working (biting) and balancing the jaw. This activity equalizes the tonus of antagonist muscles. But we can also achieve comparable equalization of muscle tonus through exercises designed for that purpose.

Masticatory Disturbances

- unilateral mastication
- nail biting
- bruxism

According to Padovan, a child's baby teeth begin to imprint the helical chewing pattern when the child is about three years old. This is the same time at which the child begins to display contralateral motion. It is also the time when the child begins to use the first-person pronoun, "I": "I want to eat," instead of "want to eat." Thus we see the structural, functional, and psychobiological realms flowering simultaneously!

Sucking

Working with sucking is essential because sucking is the most comprehensive of the reflexive/vegetative oral functions. The pressure of the tongue against the palate, along with nasal breathing, sustains the upright posture. A chronically resting tongue begets hypotonic muscles of mastication and hypertonic hyoids, which bring the head forward and cause the thorax to collapse over the abdomen.

The main sucking muscles are the infrahyoids and suprahyoids and the extrinsic muscles of the tongue, the intrinsic muscles of the tongue being more important for swallowing and speaking.

The intrinsics of the tongue are:

- the superior longitudinal muscle, which shortens/broadens the tongue, and curves its tip and sides toward the roof of the mouth to form a concave upper surface;
- the inferior longitudinal muscle, which shortens/broadens the tongue, and depresses its tip toward the floor of the mouth to form a convex upper surface;
- the transverse muscle, which lengthens/narrows the tongue; and
- the vertical muscle, which flattens and broadens the tongue.

The extrinsics of the tongue are:

- styloglossus, which raises the tongue to the palate, brings it backward, and cups it;
- genioglossus, the anterior fibers of which reach the tongue out of the mouth, and the posterior fibers of which retract it;
- palatoglossus, which acts as a sphincter to isolate the oral cavity from the pharynx during swallowing and speaking; and
- hyoglossus, which depresses the tongue and brings its lateral borders towards the floor of the mouth.

The base of the tongue is formed by extrinsics – the geinoglossus, palatoglossus, hyloglussus, and chondroglossus, which inset into the hyoid bone. In sucking, the tongue undulates upon, puts pressure against, and opens the anterior portion of the palate. The tongue is raised by the styloglossus, which brings the tongue toward the palate at the same time it brings the hyoid bone superior in order to close the larynx so that food and saliva may descend through the pharynx. For this function, the suprahyoids and infrahyoids act as antagonists, raising and lowering the hyoid bone. Working with sucking, we can bring the tonus of these muscles into equilibrium.

Seeking and finding the breast, which precede sucking, initiates and stimulates an unwinding of the fetal position and brings a tendency to lift up the superior portion of the thorax. This is true in adults and the elderly, as well as in infants. The search stimulates the achievement, the same as when the infant seeks its mother's breast. And, because there is no achievement without a "pull" in its direction, we see the dynamic of the opposing forces that organize the axis, which begin to show themselves in the earliest infancy.

Among adults and the elderly, practicing sucking recovers and organizes this action/attitude, which is effectuated through the deep musculature and not through the fascia. The action of the tongue pressing upon the palate generates an impulse in humans equivalent to the heliotropic tendency in plants, and develops the sense of spatial orientation emphasized by the work of Hubert Godard.

Sucking brings about nasal breathing. The combination of sucking and nasal breathing allows the infant to support its head and establish motor control of its neck. They also permit the infant a greater experience of motor coordination. Could it be that the coordination of sucking, swallowing, and breathing, in their three different rhythms, is the cradle of motor coordination? (See the thesis of Manoel Souza e Cunha at www.fmh.utl.pt/mestradodc/a succao.doc.)

Sucking protrudes the mandible, which is retracted in the fetal position. This movement also disengages the sympathetic activation of the muscles of mastication. The rhythmic movement that sucking produces in the pharynx, which is connected to the cervical column at approximately C4, generates a vibration (like a cat's purr) that can either relax or tonify the cervical region.

Sucking produces endorphins and engages the hippocampus to produce the proteins BDNF (brain-derived neurotrophic factor) and GDNF (glial cell-derived neurotrophic factor), which increase cerebral activity and enhance the neural plasticity of the hippocampus in functions such as memory and imagination. Sucking is, therefore, highly recommended for the elderly. Sucking also stimulates the peristaltic activity of the digestive tract.

In balancing the tonus of the hyoids, it is worth emphasizing the role of the digastrics, which originate at the occiput and insert into the mandible. The posterior belly of the digastric functions like reins on a horse and has considerable influence on

head position. We should also emphasize the importance of the omohyoid, which originates at the hyoid bone and inserts into the shoulder blade. Contraction of the omohyoid narrows the thoracic inlet and the superior portion of the thorax itself.

Sucking Disturbances

- prolonged thumb-sucking
- use of pacifiers

Respiration

Respiration begins at birth. If all goes well, the baby begins to breathe through the nose and activate the musculature of the diaphragm. Because the mechanisms of respiration are well known among Rolfers, I will not describe in detail the muscles involved, the phases of respiration, or the basic respiratory dysfunctions (inspiration fix and expiration fix) and their postural and muscular characteristics.

But I would like to highlight the importance of nose breathing, in which the nose filters, humidifies, and warms the air so that it reaches the lungs at 38°C (the air temperature determines the flow of blood in the lungs). Having entered through the nose, the air passes under the sphenoid, which is warmed by the heat cerebral activity produces. Thus, as the air passes from the nose into the nasopharynx, a heat exchange takes place in which the air is warmed and the brain is cooled. Inadequate cooling of the brain (having a "hot head") can be responsible for hyperactivity, deficits in attention and concentration, and emotional lability.

Without nose breathing, the cold and unfiltered air that reaches the lungs creates an opening for respiratory disease. The mucosa of the nose contains 20% of the autonomic nervous system's pathogen detection receptors. Finally, pheromones, which stimulate sexual behavior, are registered by the osmaceptors near the vomer.

Mouth breathing generally arises from difficulties at the time of breast-feeding, as it is during this time that nose breathing should be established. Oral health professionals have observed that many problems accompany mouth breathing. Health problems include:

Disturbances from Mouth Breathing

- allergies
- enlarged tonsils
- earaches
- sinusitis
- apnea

Mouth breathing can also induce emotional and behavior problems, such as:

- attention and concentration deficits
- hyperactivity
- fatigue
- emotional lability
- low libido

Finally, aesthetic and functional changes from mouth breathing include:

- oval face shape
- open mouth
- hypertonic orbicular muscles of the lips
- narrowed nose
- arched palate
- dento-facial deviations or deformations

Swallowing

We swallow between 500 and 1,500 times each day. Saliva, besides dissolving food, protects the esophagus from the gastric juices produced by the stomach. Swallowing takes place in four phases:

- the anticipatory phase, in which the tongue projects forward,
- the oral phase, in which the tongue undulates upon the palate,
- the pharyngeal phase, when the supra and infrahyoid muscles suspend the hyoid bone so that the larynx is closed, and
- the esophageal phase, when saliva or food passes into the esophagus.

The main structures involved in swallowing are:

- the hyoid bone
- the tongue
- the suprahyoids and infrahyoids, which raise and lower the hyoid bone
- the muscles posterior and extrinsic to the tongue
  - styloglossus, which raises and cups the tongue
  - hyoglossus, which depresses the tongue
  - genioglossus, which projects the tongue forward

Swallowing Disturbances

- atypical swallowing, which produces excess saliva that can be expelled during speaking
- drooling

Conclusion

Working with the four vegetative oral reflex functions has greatly enhanced my own comprehension of the structural, functional, and psychobiological dimensions of bodily organization, as well as the interplay among those dimensions. Perceiving the effects of the TMJ on the lateral line, diaphragms, shoulder girdle, thoracic inlet and spine has given me a better understanding of the dysfunctions that can happen in those areas. It seems to me that Rolfers often underestimate the enormous strength and reactive capacity of the muscles of mastication in all dimensions of being.

Understanding how the musculature of the stomatognathic system is involved in posture makes possible different approaches, from specialized touches to differentiate these various muscles and other structures to oral exercises. Approaches may be directed to primary mechanical patterns that have not fully matured, or to dysfunctional patterns resulting from the mechanical activation of the limbic system. (Dysfunctions arising from genetics or misaligned teeth are beyond the scope of these approaches.) The results of the manipulation, amplified by the oral exercises, made it possible for me to give clients tools that both allow them to discharge the limbic activation and reeducate their systems.

Seeing how opposing forces organize the axial complex is reinforced by an understanding of the tongue's role in this dynamic. It is very difficult for a mouth-breather to maintain an erect posture because keeping the tongue on the floor of the mouth to permit airflow creates excess tension in the infrahyoids. This is described in studies by phonoaudiologists and biomechanical engineers concerning the axial forces imposed by the tongue in mouth breathing versus nose breathing, in premature infants, and in persons with Down's syndrome and cerebral palsy. Given the need to objectively evaluate the power of the tongue, the Biomechanical Engineering Group at the Federal University of Minas Gerais (State of Minas Gerais, Brazil) has devised an apparatus to measure the axial forces produced by the tongue.

But, do the oral exercises allow us to make changes in well-established patterns? It depends on the client's age, as well as on how regularly the client practices

the exercises. And, more important than achieving specific changes is the capacity of the functional tools to bring about maturation of the vegetative oral reflex functions, as well as the client's cognizance of them. And, according to both the work cited above and my own experience, the changes we can effect are significant.

I could tell you about many clients who, after practicing the oral exercises, feel better contact of their feet with the ground, have longer necks, and can sense the mobility of the spine's contralateral movement manifests itself. Some day I will prepare an article just to tell you about my clients' responses.

I want to be clear that the objective of my work with the four vegetative oral reflex functions is the fundamental one of integration of the body in gravity. I do not pretend that this work is a substitute for the work of oral therapists. My intention is to cooperate with them to open a new area of work for us. Actually, I believe there are many things for us to discover through these ideas. That is why I wanted to present them to you: so that we can enrich our practices and the possibilities of helping our clients.

Endnotes

1. This article was translated and adapted by Heidi Massa from Pacheco's article on the same subject published in *Rolfing Brasil*, Vol. 9, No. 29 (July 2009).