

Add the Voice to your Functional Treatment Plan

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The efficiency of the human musculoskeletal system lies in its economy. The minimum number of levers and pulleys supply the maximum number of different demands. Thus many of the ligaments and muscles responsible for the forces involved in singing, swallowing, breathing, or lifting heavy objects are also responsible for the forces which move the jaw, position the tongue, provide the rhythmic pump action to expel fluid from the Eustachian tubes, balance the head on the spine, or the spine and pelvis over the feet. The clinical disciplines working to correct dysfunction in any one area can include dentists and orthodontists, cranial osteopaths, cranial chiropractors and exercise therapists. Because none of these disciplines can hope to become expert in the total diversity of even one area, multidisciplinary teams are gradually forming to work together to support not only the patient, but each other. Shared input is also shared responsibility.

Clinical disciplines all study functional anatomy as part of their training and that can be the starting point for a working relationship. The mandible is suspended from the temporal bones of the cranium, which need to be functioning symmetrically to facilitate successful maxillary expansion or occlusal correction. A cranial osteopath or cranial chiropractor can realign temporal bones and as both disciplines are now accepted as treatments within the European medical framework, there is no danger of unprofessional conduct to an orthodontist who refers a patient there.

I first researched the links between dentists and other structural clinicians through searching for ways to solve my own voice problems. Armed with this information I discovered that a large number of the people who consulted me with voice problems also had structural problems. These included clicking jaws, inadequate vertical dimension, or they may have had major extractions, which reduced skeletal support and caused physical misalignment and cranial torsion. I received no training in functional anatomy fifty years ago for my career in singing; even though in 1956 Sonninen (1) discovered that the extrinsic frame of the larynx regulated the vocal folds, thus affecting the voice. According to my findings this situation has not changed. Many of the structurally misaligned performing musicians and singers had been diagnosed with 'Performance Stress' and were attempting to deal with it via a psychological or emotional route. Their personal confidence was poor. In order to provide help for them the first multidisciplinary team was put together that included a dentist, a cranial chiropractor and a voice teacher (2).

It soon became clear that the result in the 'team' treatment of patients who also did voice work was a much faster response to treatment, particularly with appliances. Not only can

measurements and photographs be compared to prove the treatment is progressing well, the patient can hear and feel the changes in the daily use of the voice. There is also the possibility of the patient taking some responsibility for part of the treatment, as opposed to paying for someone to totally provide it. Anyone treated by any means has to at some stage take over the responsibility for linking the recovery into their own lives. VoiceGym voice and body exercises (Figure 1) can provide the means of this involvement. For instance the patient can personally improve the function of face muscles and tongue through exercise and understand why they are doing it (3,4). This also promotes dialogue between patient and clinician.

People enjoy singing. It is a natural human characteristic that energises and makes you feel good. That 'feel good' factor also encourages the patient to express attitudes and feelings about the treatment. A treatment plan which accesses positive factors like these is likely to also access natural self-righting mechanisms.



Figure 1. Revisiting the early cross-patterning reflex in adults using balance and stretch (4)

Mechanical links between Structure and Voice

The Hyoid

The hyoid is part of, and crucial to, the mechanical interface between cranium and mandible. Bibby and Preston (5), discovering the upper airway stability provided by the hyoid triangle stated that “without it (the hyoid) our facility for maintaining an airway, swallowing, preventing regurgitation, and maintaining the upright position of the head could not be as well controlled”. They admit that the hyoid tends to be overlooked and although their paper is the first to review all the relevant literature there is no mention in that literature of the effect of the voice on the hyoid, even though the source of the sound that we make is the larynx, which must retain independent flexibility to speak, and that is suspended from the hyoid. The hyoid is



Figure 2. Mandibular connection to the stylohyoid ligament (6)

connected to the mandible via the Mylohyoid muscle and to the cranium via the stylohyoid ligament. This ligament also has a connection to the mandibular angle (see Figure 2). Dysfunctional speech and singing often cause an unnaturally high larynx, which, raises the hyoid. Through this connection the mandible is also driven up and retruded into the joint space at the TMJ.

The hyoid is the main skeletal connection for the tongue. The excursion of the larynx down the pharynx for the 'in breath' requires the position of the hyoid to be flexible, made possible by the supra and infra-hyoid muscles. Balance between these muscles is maintained by the efficient action of swallowing, breathing, speech, singing and natural upright posture. If hyoid flexibility is seriously imbalanced, this can alter the range of flexibility of the hyoid and cause a wave of muscular distress to the TMJ and throughout the neuromuscular system.

Tongue thrust is not just a dental problem

Andrianopoulos and Hanson (7) found that one of the main factors suspected of contributing to the tendency of teeth to return to their pre-treatment position is tongue-thrust. Their study is one in extensive literature devoted to the importance of tongue resting position in the achievement of a satisfactory treatment result with no long-term regression. It also states that a forward tongue causes dysfunctional breathing (through the mouth), deviate swallowing and forward head neck posture through displacement of the hyoid bone. Tongue position and the possible means of changing it are a very serious consideration in the planning of all musculo-skeletal correction. Its connection to the hyoid and from there into the scapula via the omohyoid muscle links the tongue into a chain of muscles involving muscles of the trunk responsible for physical stability, rotation and strength. Therefore the position of the tongue can stabilize or destabilize whole body posture and function.

Numerous dental appliances are fitted with 'spinners' and other devices to interfere with the tongue tip and encourage it to move the whole tongue back and up. However, the tongue is made up of both voluntary and involuntary muscles, the latter only responding to the imagination. Singing and the reciting of imaginative poetry accesses both rhythm and the imagination, exercising both voluntary and involuntary muscles of the tongue. However this is only possible if speech and singing are themselves functioning efficiently.

Speech, the Mandible and the Tongue

Modern man differs from all other creatures in three significant ways:

1. Upright posture
2. The enlargement of the cerebral cortex of the brain
3. The low larynx

These developed interdependently over the last 100,000 years and the latter caused the shift of the tongue at between two and six years old from a position totally in the mouth, as in both the infant and adult chimp, to having one third of the tongue in the mouth and two thirds in

the pharynx, forming its anterior wall (8). Chimps, with the tongue entirely in the mouth, can be taught vowels by shaping the mouth itself but only the right angled tongue position of the upright hominid can articulate consonants and facilitate sophisticated speech. Crelin (8) stated that “Ultimately, articulate speech led to a complicated spoken and written language, abstract thought, the fifth Symphony and the theory of relativity.”

Human speech uses three different articulation systems:

1. The making of pitched sound – by the vocal folds within the larynx
2. Vowels – by the shaping of all three constrictors of the pharynx and its anterior wall, the main body of the tongue.
3. Consonants – by the action of the free third of the tongue in the mouth.

There is some muscular overlap in the articulation of vowels and consonants. We function rhythmically as the result of the antagonism between movement and gravity. The pumping of the cranial fluid, the excursion of the larynx down the pharynx and the cross patterned action of walking are some of the many body systems that function rhythmically. The rhythmic down-spring of the larynx in breathing, speech and singing springs a further third of the tongue backwards into the pharynx causing the third of the tongue remaining in the mouth to *implode* consonants, rather than *explode* them. This regular implosion of consonants within the syllables of speech uses the styloglossus muscle to pull the tongue back and up to implode against the palate, alveolar ridge and palatine arch, rather than forward and down to explode against the teeth and the lips. It ensures exercise of styloglossus *every time we speak*. Styloglossus is the muscle that ‘suckles’ the nipple in breast-feeding and if the early development of speech maintains the strength of styloglossus in the articulation of consonants and vowels, natural rest position of the tongue against the palate and away from the teeth to breathe through the nose, is also maintained. The distance the tongue has to cover between its attachment to the styloid process of the skull, the lower rim of the mandible and a hyoid attached to a low larynx demands intricate and muscular movements to articulate the sophisticated speech patterns of Homo sapiens. Efficient speech builds the strength of styloglossus and imploded consonants encourage vowel resonance throughout the physical structures of the trunk.

An efficiently functional tongue thrusts sideways against the maxillary arch posterior of the premolar teeth, thus providing natural arch expansion for life. This simultaneously widens and lengthens the pharynx facilitating both the movement of air from the nasal sinuses and the shaping of vowels. Unfortunately many singing teachers insist that the tongue should lie flat in the floor of the mouth to sing, using the lips and teeth to spring the tongue in consonants and ‘project’ the voice. There is currently no globally consensus on voice training as the disciplines of speech and singing are generally considered to use the voice mechanism differently. The establishment of Interdisciplinary treatment protocol including voice would change that, as it did for me. I am hoping that IFUNA with its International Education programme will be that instrument for change

The Function of the Face

The full development of the maxilla in children brings about the downward and forward development of the face. A large percentage of orthodontics is concerned with correcting maxillary underdevelopment (9). Although establishing a natural tongue position is a critical factor in arch expansion, much can be done to help the process by toning the face muscles. What is the first effect of inserting a dental appliance? The face muscles behave in the same way as they do when you get a raspberry pip in your teeth. You play with the offending intrusion with every muscle you can co-opt. Face muscles intended to widen the maxillary sinuses and dilate the nostrils for nose breathing are pulled inwards and downwards towards the teeth exerting the opposite pressure to that required for forward expansion. In the 'team' protocol for expansion that includes voice I often begin the treatment by giving exercises to drop the hyoid, begin the tongue shift and open up the face with exercises that improve the vocal efficiency described above. This develops a lateral and uplifting 'drag' on the face. In a patient with a narrow maxilla this may be the first time these muscles have been made to work in this way, so silly games and poems that access manic cat faces abound - for adults as well! This is hard work for the patient, until an appliance is introduced which speeds the process. The result is that the patient feels involved, works hard at the exercises, doubles the effect of the appliance and reduces treatment time.

The Efficiency of Tensegrity Structures

Tensegrity was coined from the phrase 'tension integrity' by the designer Buckmaster Fuller, working from original structures developed by the artist Kenneth Snelson (10). Although every structure is ultimately held together by a balance between tension and compression, tensegrity structures maintain their integrity due primarily to a balance of continuous tensile forces through the structure as opposed to relying on continuous compressive forces. Our commonly held impression is that the skeleton is like a brick wall: that the weight of the head rests on the 7th cervical, the head and thorax rest on the 5th lumbar, which must bear the weight of the whole body. This weight is transmitted down to feet and from there in to the earth. This is a continuous compression structure. The stability of a tensegrity structure is less stiff but more resilient than the continuous compression structure (Figure 3). Load one part of it and it will give a little to accommodate. Load it too much and the structure will ultimately break but not necessarily where the load was placed, as the structure distributes strain through the lines of tension. The different individual treatment of all clinicians must overlap throughout the human tensegrity structure if correction is to return the patient to maximum function. To achieve this there has to be regular discussion between the clinicians involved.

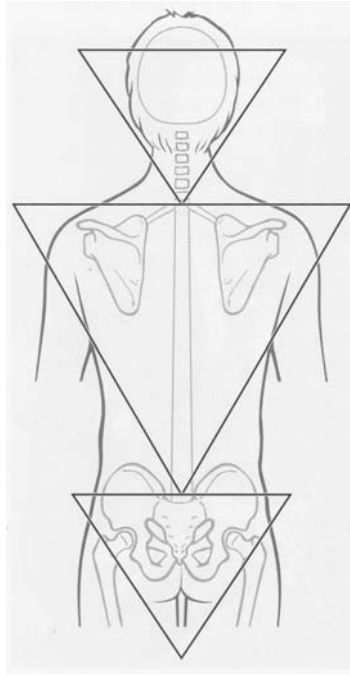


Figure 3a. A compression structure (10)

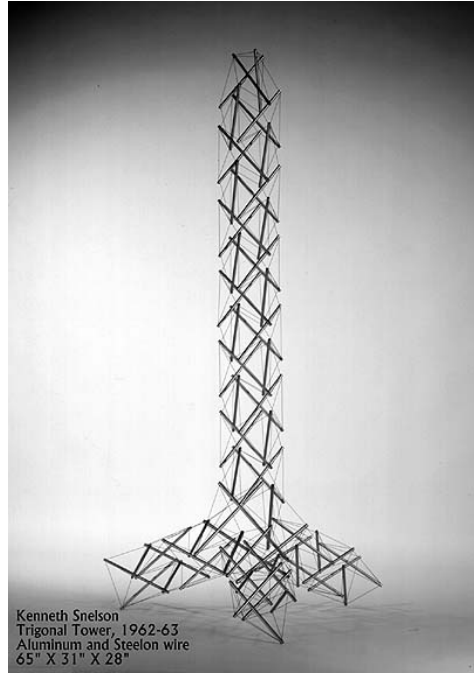


Figure 3b. A flexible tensegrity structure constructed of rods and wires (10)

The Importance of Voice in the Early Years

The newborn infant has six more years of development before the position of the adult larynx and tongue will be stable and the palate of the size ready to begin to accommodate the adult teeth. It is during these years that the development of speech, singing, upright posture and rhythmic movement can have the greatest effect on the development of the maxilla, mandible and dentition. But there are now fewer places for children to run and jump, chatter and climb and all these are necessary activities to develop posture and the dental arches (Figure 4). Many children are now visually over-stimulated, which also reduces physical activity. Introducing Early VoiceGym (11), which is based on early reflex patterns, in these early developmental years will ensure that the relevant systems are stimulated, exercised and coordinated (Figures 5 and 6). A paediatric cranial osteopath or chiropractor who monitors the child from birth can maintain the balance between genetic predisposition and the development encouraged by voice and body exercise and informed parents. This prepares the way for the orthodontist to assess whether any help is needed, before the maturation of the central nervous system at ages 7 to 8 makes change more difficult.



Figure 4. Up, up and away! (3)

There have so far been no studies, no recorded experiments, on the improvements that could be made to treatment protocol by including voice and body exercise. As far as I can ascertain only a few dentists have taken this step, all from the UK. Where it has been employed, it has been successful. The emails I receive from people all over the world who are seeking 'voice aware' dentists indicate that a properly controlled and conducted study is now overdue.



Figure 5. Singing with co-ordinated movement highlights any weakness in early reflex patterns, which can then be revisited (11)

At the first IFUNA meeting in Paris in 2007 I noted the desire of everyone there to connect with a level of discovery that could only be possible through working with each other across the globe. Last week I visited The Eden Project (12), where a disused and organically dead clay pit in Cornwall UK was transformed by Tim Smit and his team into "a global garden exploring our place in nature". In his introduction to Eden the founder, Tim Smit, says "Eden is about optimism and the possibility of change. It is about the fragility of certainty and the feet of clay we all suffer from. Our work with communities across the globe shows how quickly change can be made to happen when people work together and understand that 'sharing' makes us more than the sum of our parts (12)."

In its adult evolution is not Homo Sapiens - the wise hominid - a complete organic environment in itself? If this is acceptable any corrective treatment can only be deemed to be truly successful when there is improvement of function of the whole human being. Treatment should not merely 'correct' symptomatically but also reactivate those skills we lost through having the problem, thus increasing personal happiness, spiritual well being and though it giving us something more to do with our lives.

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Figure 6. Revisiting the early cross-patterning reflex in children with Early VoiceGym (11)

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Angela directs The Voice and Body Centre (www.voicegym.co.uk), the aim of which is to teach a simple, effective and practical approach to the development and maintenance of the whole voice. Over the last 15 years she has developed VoiceGym, a complete voice and body exercise system that is now used extensively for the development and maintenance of professional voices, and Early VoiceGym, which revisits and revitalizes early reflex patterns in children.



Angela's work crosses the barriers of many different disciplines. She has established a multidisciplinary network, involving cranial chiropractors, pediatric osteopaths, orthodontists and dentists who are voice-aware so as to provide answers and support for singers and other professional voice users. Professional instrumentalists are increasingly using the programme to provide the understanding of the mechanics and physiology of performance not acquired in their traditional training. She is a member of *The British Society for the Study of Cranio-mandibular Disorders* (www.jawache.com), a study group promoting the multidisciplinary treatment of dental and structural problems, and a member of *Cranio Group* (www.craniogroup.com).