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Orthodontics in a Quantum World II: Cranial Movement and Parafunction

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Abstract: *Maintenance of brain vitality is the most important function of the body. Several oral behaviors are involved in this process. Typical facial characteristics and intra-oral change can result from this. Symptomatically, the response can resemble a temporomandibular joint disorder. An integrative systems approach gives a basis for understanding and treating the condition.*

In the first article in this series[1] it was argued that the body must be seen as an open system rather than a closed one. The name Integrated Systems Biology has been given to this concept by Noble,[2] a leading physiologist and systems biologist. Some of the implications of this approach were discussed and it was proposed that the mouth is a major factor in maintaining the stability of the body. In this context, oral parafunctional behaviors have a physiological role rather than being considered as idle habits whose aetiology is not really understood.[3] The study of oral parafunction also helps to provide a transition from the linear thinking which currently dominates scientific investigation of the body, to the idea of non-linear, self-regulating processes now recognized as being at the heart of a biology incorporating quantum as well as Newtonian mechanics.

There are two particular ideas which are of help in understanding a non-linear approach. The first is that of redundancy, as used in engineering terminology. What this means is that an engineer builds fail-safe devices into a design so that should a machine fail, a feedback process triggers a backup mechanism. Redundancy in this sense occurs widely in the body. The more crucial the function, the more likely it is that there will be such backup processes. For example, Noble,[2] using a virtual heart model, has shown that as the sodium protein level of the cardiac pacemaker diminishes, there is a compensatory increase in the level of other proteins, thus helping to maintain the regularity of cardiac rhythm. Oral parafunctional behaviors fit very well into this concept of redundancy as will be shown.

The second idea is that as a self-regulating entity, the body "chooses" how it responds to an internal or external stimulus. The word "chooses" has been put into parenthesis to emphasize that this is not a conscious choice made by an individual but is an inherent characteristic of any organism. As cell biologist Ho[4] has demonstrated, even unicellular organisms, which have survived in one form or another for more than two billion years, have the ability to absorb nutrients, circulate them through the cell and excrete waste products. They can move towards a favorable environment or away from an unfavorable one. They are able to do so with only a very rudimentary level of physiological organization. The body, which consists of about 50 trillion specialized cells,[4,5] has all this capacity plus many more mechanisms to assist in its survival. The mouth is involved in a number of such processes. The intake and eating of food is one obvious function, as is speech. Assistance in maintaining an airway is another. Oral parafunctional behaviors also play an important role but this has not been recognized since their influence may be on structures seemingly remote from the mouth. Such oral behaviors can be grouped roughly into three categories based on their functional contribution. These categories are not all of the same importance. Figure 1 illustrates this.

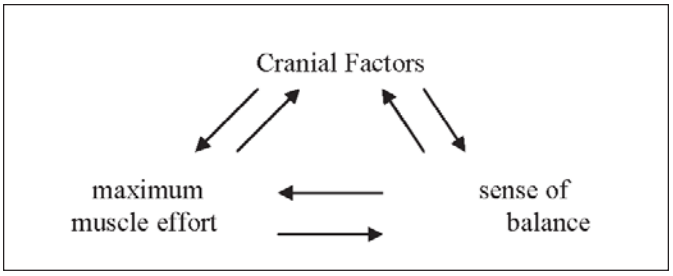

Figure 1

Cranial factors have deliberately been placed above the other two as being the most important. Specific parafunctional behaviors may be involved in more than one functional group, hence the two-way arrows.

Cranial Factors and Oral Physiology

At the death of an individual there is cessation of breathing, then cardiac failure, followed by a gradual slowing down of the cranial rhythm until it also stops. The cranial rhythm is the regular flexion and extension of the occiput and sphenoid at the sphenobasilar symphysis. This last process can take up to thirty minutes or more.[6,7] Conventional medicine recognizes brain death rather than cardiac failure as the final event in the dying process. For example, the removal of organs for transplant purposes is normally not done until all electrical activity in the brain has ceased. The body tries to keep the brain alive by circulation of cerebrospinal fluid even after cardiac failure. It is reasonable to conclude, as have the osteopaths,[6,7] that maintaining the vitality of the brain is the most important single function in the body. The mouth is heavily involved in this.

Normal oral function stimulates and helps maintain cranial flexibility. In chewing there is a distribution of force from the maxillary teeth via the maxillae to the sphenoid bone. This is augmented by the action of the masseter and temporal muscles on the lateral aspects of the skull, plus the actions of the external and internal pterygoid muscles. The sphenomandibular and stylomandibular ligaments attach directly to the cranial base. We think of them as acting to limit mandibular movement, but there is an equal and opposite force transmitted through them to the cranial base, helping to keep it flexible.

There may be restriction of the cranial rhythm as a result of trauma to the head or as the residual effect of a distortion of the cranial base, i.e. a cranial strain.[8] Various additional mechanisms involving the mouth are then harnessed to stimulate cranial movement. The most potent is nocturnal clenching of the teeth. Pressures of 250 pounds per square inch or more have been recorded.[3] It is very difficult to achieve a level of force anywhere near this when awake, let alone sustain it. The gain from such clenching, i.e. mobilizing the cranium, outweighs the discomfort and pain which can result. Such pressures are generated at night when the protective mechanisms present during waking are overridden.

Not surprisingly, the frequent application of such a heavy force has consequences which can be found both in structural adaptation and symptomatically. Facially, the most common response is hypertrophy of the masseter muscles (Figs. 1a, 1b). With time, there may be lateral flaring of the gonial angles of the mandible, giving a distinctive facial appearance. Intra-orally, in the maxillae there is a thickening of bone along the palatine suture. This can be found occasionally in children. In adults the development of a palatal torus is the common response. Another reaction can be the appearance of bony exostoses on the buccal aspects of the maxillae (Fig. 2). In the mandible (Fig. 3), lingual tori develop to strengthen the mandible at a weak point in its bony architecture. All these bony changes are examples of Wolff's law. They show the bones' response to the heavy forces being exerted on them. As previously mentioned,[1] psychological factors can be contributory to clenching but where these physical chacteristics are obvious, and the clenching is nocturnal, there is the probability of a cranial factor being present.

Figures 1a & 1b: Patient showing hypertrophy of the masseter muscles and mild flaring of the gonial angles of the mandible.

Figure 2: Intra oral view of patient in Fig. 2 showing bony exostoses on the buccal aspects of the maxillae.

Symptomatically, patients with nocturnal clenching will present with signs and symptoms suggestive of a temporomandibular joint disorder. Typically, they

complain of headaches on waking, usually in the temporal region. These headaches can be severe enough to waken them during the night. There is marked stiffness and pain over the face and the temporomandibular joints on first waking. Overnight, the muscles have had a build up of lactic acid which causes irritation, but this gradually resolves on the resumption of jaw movement. In the temporomandibular joints the condyles have been driven hard into the glenoid fossae, squeezing the synovial fluid out from between the articular surfaces. If there is clicking of the joints in normal daily

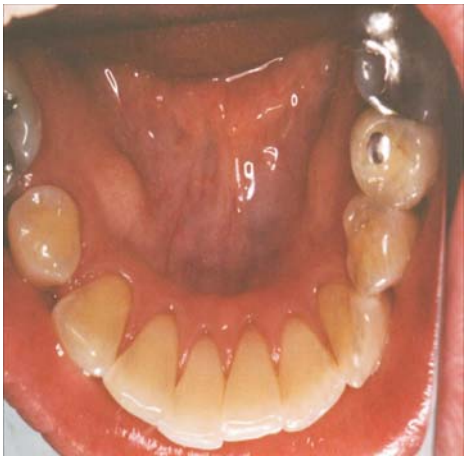

Figure 3: Intra- oral view of patient's mandible showing tori on both sides.

movement this may be absent on first waking, the condyles having been compressed distally off the discs. It may take a few minutes or even an hour or more to recover the normal range of mandibular movement. This is often accompanied by a sharp noise and/or pain as the discs become repositioned on the condyles.

Identifying a cranial component as the primary aetiology in an apparent temporomandibular joint dysfunction is straightforward if a thorough history is obtained and the appropriate signs and symptoms are present. The history should include information, if known, as to what kind of birth there was, e.g. prolonged labor, cesarean section, etc. Questions should also be asked as to whether there were problems following birth. Feeding difficulties, excessive crying, sleep disturbances or colic in the post-natal period are indicators of possible cranial restriction (cranial restriction is the limitation of movement at the sphenobasilar symphysis).[8] Habits such as head rubbing or head banging in infancy are also indicative of restriction. In older children and adults, a history of previous significant trauma, especially to the head, is important. If there has been a motor vehicle accident, the type of injury sustained should be noted. Trauma from sports activities can also be contributory. These include figure skating, ice hockey, football, soccer and gymnastics.

Figure 4: Mild scalloping on the lateral aspects of the tongue. Maxillae are constricted laterally. Tongue pressure is transmitted to the cranium.

Figure 5: Severe scalloping plus soft tissue breakdown due to enamel irregularities. Patient has severe cranial restrictions plus a reverse overjet due to a Superior Vertical Strain.[22]

Given the primary importance of rhythmic cranial movement, several other mechanisms to ensure its adequacy could be expected. The most important is that of suckling. This is a powerful stimulant in establishing a good cranial rhythm immediately after birth.[6, 8] Failure to develop a normal suckling pattern is therefore not just a problem of feeding but can lead to a less vigorous cranial rhythm. Moyers and Carlson[9] have described in detail the maturation of an infantile swallow into that of an adult swallow. The failure to make this transition has been associated with a number of factors including airway blockage and swallowing problems.[10, 11] It is now suggested that a tongue thrust may persist so that the tongue can continue to stimulate a sluggish cranial movement. Marasa,[12] a dentist with cranial manipulation skills, has recently

published a thorough description of how the tongue and other muscles involved in swallowing activate the cranial mechanism. It would be useful to examine a number of patients in the 7- to 9-year age group who have persistence of tongue thrusting but with no airway problems and compare them with a matched control group having an adult swallow pattern. A blind osteopathic evaluation of both groups could establish whether the incidence of cranial restriction is significantly higher in the tongue thrust group as seems to be evident from clinical experience. If this proved to be the case, cranial adjustments, if available, would be indicated as an initial step in the overall treatment plan.

Rethinking tongue behavior in the light of an integrative systems approach is surely appropriate and timely. For example, a common finding is scalloping along the borders of the tongue (Figs. 4, 5). This may be obvious or so mild that it is not readily seen. Its presence is indicative of the tongue being used to expand the palate and move the maxillae, either anteroposteriorly or laterally. The pressure from the tongue is transmitted in turn to the cranium. The patient in Figure 6 has lacerations of the tongue from the extreme forces being developed and from the fractures of the enamel. There are severe cranial restrictions present in this patient.

Another redundant mechanism used to mobilize the cranium is finger or thumb sucking as was discussed previously.[1] When the habit persists at a high level of activity after approximately six years of age it is a strong signal that a cranial distortion exists. This applies still more when the habit continues into the teens or even into adulthood. How the individual actually sucks the thumb or finger can be of diagnostic value as an indication of where a restriction of the cranial bones may exist.

Finally, there is yet another mechanism available to the body to overcome cranial restriction, although the mouth is not so directly involved. This is by the individual taking a deep breath and holding it. This is a common finding which will be discussed in the next article on muscular effort. The effect is to put the cranium into flexion.

As dentists we should at least try to understand the implications of cranial movement and how it impinges on our sphere of responsibility. This is not only so that we can modify our intervention appropriately. It also helps us to appreciate the role of the mouth in the maintenance of overall health. As recently as twenty years ago, the most likely dental response to nocturnal clenching would have been occlusal equilibration, the rationale being that the clenching was an attempt to eliminate an occlusal interference.[13] Latterly, the preferred approach has been the use of a dental splint.[14, 15] This is mostly to protect the teeth from the sensitivity generated by the excessive forces being developed. A maxillary splint has the disadvantage of possibly restricting maxillary movement and thus aggravating the problem of cranial restriction rather than relieving it. A mandibular splint is therefore preferred whenever possible.

A splint may be used as a palliative device to redistribute the pressure being exerted on the teeth or to relieve joint and muscle pain.[14] It can be used as a diagnostic aid, helping the clinician to find centric relation, or it can be an active treatment modality e.g. the indexing of a mandibular splint to stabilize the mandible and permit healing of the temporo-mandibular joints.[16, 17] With an appreciation of an integrative systems approach and the role of the mouth in maintaining overall health, splint therapy becomes a more sophisticated and precise treatment modality than is generally practiced. The systems approach provides an objective way of testing whether a splint is even indicated in the first place. If it is, then it is possible to use a splint in a quite specific way from the beginning of treatment, e.g. by leveling the maxillary cant caused by a torsion.[18] This is contrary to the widely held view that a first phase of treatment for temporomandibular problems should concentrate primarily on stabilization of the joints.[16, 17] The snag with such stabilization is that it tends to leave any cranial problems still in place. As many TMJ disorders have a cranial component it means that this is not being effectively addressed. The cranium is not a rigid structure as we have been accustomed to think, but is capable of changing. In 1962, Magoun[19] said that "the mobility of the mandibular fossae is of the greatest significance to the practice of dentistry and should be more widely recognized." As a profession we have failed to do this. The sooner cranial treatment can be given the better. In this way, some of the stresses on the temporomandibular joints can be reduced.

As the body adapts to the presence of the splint, constant adjustments need to be made to the splint to ensure it continues to be of maximum benefit. There are objective, measurable techniques available whereby the body itself can be used as an indicator of what its response might be to any proposed intervention. These techniques are effective because of the presence of electromagnetic fields throughout the body. The result of any alteration in the mouth is instantly communicated to all the tissues of the body. This concept will be addressed in the next article.

The Advanced Lightwire Functional (A.L.F.) appliance has been designed specifically to deal with both cranial and dental problems. Nordstrom,[20] who devised the A.L.F. appliances, has worked closely with osteopaths for many years. He wished to have an appliance which would work primarily in helping to release cranial restrictions and secondarily to treat any malocclusion present. If osteopathic assistance is available, a combined dental-osteopathic approach can provide the dentist with additional information allowing him or her to adjust the appliances so as to achieve maximum effectiveness. There is a synergistic effect from such a coordinated approach which greatly speeds up treatment. Even where an osteopath or a therapist with cranial skills is not available, an understanding of the cranial strains previously described[21-26] enables the dentist to direct his or her treatment more effectively.

This article has argued that the mouth is an important part of the body's mechanisms for achieving and maintaining cranial flexibility and with it the most physiological state of the brain. The next article examines the mouth's role in achieving a high level of muscular effort throughout the body. A fourth article looks at oral behavior in relation to balance, posture and how the body counters the forces of gravity. Collectively, they offer a very different view of oral physiology but one which is consistent with integrated systems biology.

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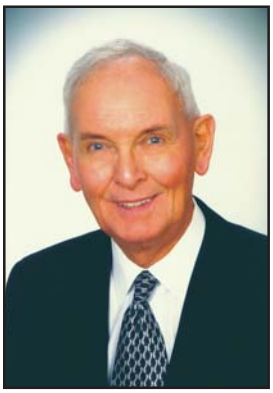

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