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Orthodontics in a Quantum World III: Electromagnetic Field Theory and Oral Parafunction

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Abstract: The study of electromagnetic field theory and bioenergy has established that there is an extensive communication system throughout the body by way of a functional matrix. This enables the body to use the mouth to assist it during the expenditure of effort elsewhere in the body. A variety of oral behaviors can be identified as contributing to this. To some extent, these behaviors indicate where an imbalance is present in the body.

In this article the reader is invited to look at some familiar clinical happenings and to think about them in a different way. This is not easy but it is driven by the realities of 21st century physics and biology. In one way or another these realities have to be recognized and absorbed into our thinking. This article continues the process of building the new paradigm outlined previously.[1,2]

From a dental aspect the alternative viewpoint considered in this article can be summed up in two statements. The first is that the body, as a self-regulating, vibrating system, constantly balances the flow of energy within it which acts to organize the system. The second statement is that the mouth provides a highly sensitive, flexible mechanism which influences this flow of energy.

The first statement about energy flow is already well-documented in the work of a number of authorities from a variety of scientific disciplines.[3-21] Although they come from different areas of science, there is a strong common theme, namely the significance of electromagnetic field theory in biology. A summary of their conclusions is now presented.

One form of electrical activity in the body is well understood. This is exemplified by the transmission of a signal from the brain via a nerve to a muscle. This can be easily measured e.g. with electrodes on the skin and is relatively slow (approximately one metre per second). It is characterized by depolarization and repolarization across the cell membrane. Another form of electrical activity now being intensively studied is an outcome of quantum physics.

The body is a complex, non-linear system characterized by vibration or resonance at a molecular, nuclear, cellular, tissue and organ level, all within a connective tissue framework. This has been called a living or functional matrix. The multiple frequencies or resonances involved are coupled so that random energy, fed into any specific frequency, is connected to other frequencies. This has been likened to a jazz band where each instrument plays its own variation but there is a central unifying theme. This coupling occurs at an electronic level rather than an electrical one and is therefore much more rapid. A good analogy for the two types of activity is the idea of the electrical current in a house which supplies domestic appliances such as a washing machine or refrigerator compared to the electronic activity which is characteristic of a computer or television. This latter type of energy in the body is at an extremely low frequency (<100Hz), creating very weak fields but which can now be measured and recorded. The cell membrane is understood to be a liquid crystal semiconductor with gates and channels rather than just a container holding the cell contents together. It is now recognized that cells are very sensitive to weak electromagnetic fields. There is massive complexity of communication between any one part of the body and any other part as a result of these phenomena.

This is a simplified description of some of the many complex mechanisms which are associated with electromagnetic field theory in biology. However, it outlines the scientific basis prompting a move away from thinking of the body as a collection of separate parts (reductionism) to that of seeing the body as a whole. At an instinctive level, most clinicians have some awareness of this unity but we have lacked the scientific rationale to explain the idea of holism. Electromagnetic field theory and quantum mechanics give a foundation for such a rationale. Among the various references used, Oschman[18] has been a particularly helpful source of information. His book is recommended to the reader interested in pursuing this subject further. Lipton's[20] work on cell biology is an excellent description of recent advances in that field.

The second statement, about the mouth influencing energy flow in the body, follows from the application of electromagnetic field theory to oral behavior This idea has been developed from personal observation and testing of several thousand patients over more than twenty five years. The principal research technique used has been Applied Kinesiology. This is a method of evaluating body function originally devised by Goodheart[22] in the 1960's. It was introduced into dentistry by Gelb[23] in 1977. Its best known feature is the use of the muscle test (Fig.1a) There is a great deal more to Applied Kinesiology and its uses in dentistry than has been recognized in the dental literature.[24] That said, it must be admitted that in terms of conventional physiology and neurology, Applied Kinesiology until now has not seemed to make sense. The recent advances in electromagnetic field theory and bioenergy outlined above provide a credible scientific explanation for the phenomena observed in Applied Kinesiology. Other research techniques are becoming available, which offer an alternative evidence-based investigative approach. One example is the SQUID. This is an acronym for a Superconducting Quantum Interference Device. It can read the weak electromagnetic fields in and around the body.[7,14,18] This is an expensive research tool available only in places such as a university setting. So far it has not been possible to gain access to a SQUID but it would provide an appropriate, objective way of assessing the clinical evidence gained from Applied Kinesiology techniques.

A working hypothesis is now proposed and clinical evidence is provided to support this. The hypothesis is as follows:

> *The mouth, with its massive innervation and great flexibility, acts as a control mechanism, influencing the flow of energy through the body. Oral behaviors are adopted which enhance this energy flow, allowing the body to exert maximum muscular effort. These behaviors are not necessarily a sign of pathology, but rather of physiological compensation. As such they are positive or energy-enhancing events. Imbalance within the mouth itself feeds into the total energy field as a negative or energy-depleting event.*

The first part of this hypothesis is examined in the rest of this article. The second part will be explored in the next article, which looks at the sense of balance, bruxing, and postural adaptation.

Casual observation shows that the great majority of individuals use the mouth in one of several ways when exerting muscular effort. A visit to a gym where individuals are working with heavy weights can demonstrate some of the more obvious variations. At a less noticeable level, some form of oral activity may be present during many activities, e.g. clenching the teeth when driving an automobile or positioning the mandible forward when engaged in some activity requiring concentration. The reader is encouraged to examine his or her own oral behavior during effort.

The most common reaction is to clench the teeth into maximum intercuspation. An obvious sign of this may be flexing of the masseter muscles but a general facial grimace is also common. These reactions are usually accompanied by an intake of the breath which is held throughout the effort. Both the clenching and intake of air put the cranium into flexion, which for most individuals is a strengthening action.[2] To some extent, a particular parafunction identifies where an imbalance is present. In the case of clenching, one possibility is that any imbalance is primarily cranial in origin. The clenching temporarily corrects the effect of a cranial base distortion or strain. This was discussed in the previous article on nocturnal clenching.[2] The type of clenching seen during the day is much less intense and is usually only exerted for a short time, while effort is being made.

Drawing on my considerable experience of muscle testing, there is another possibility. In order to understand this, the test is described in sequence. In step one, the patient is seated in a relaxed manner, breathing normally. The teeth are slightly apart. The lips and tongue should also be relaxed. A muscle test is then applied as in Figure 1a. The particular muscle involved is the Middle Deltoid. The level of force should only be sufficient to make the subject exert significant effort to keep the arm level, not to overwhelm them. The subject is advised just before the test that pressure is about to be applied, giving him or her time to react. In Applied Kinesiology terminology this is called testing "in the clear." It establishes a base line from which to begin comparisons. Most patients will show a high level of resistance.

In step two, the patient is requested to close the teeth *lightly* into maximum intercuspation. The muscle test is then repeated, ensuring that the level of force, the site of its application and its direction are similar to that in the previous test. Care must be taken that the patient does not alter their position (Fig.1b). This is known as "recruiting" in physical therapy terminology. Applied Kinesiology testing requires scrupulous attention to detail.[24] This has not always been followed in previous investigations and could explain why some reports have been unfavorable. The apparent simplicity of the testing method is deceptive and can lead to serious inaccuracy of results.

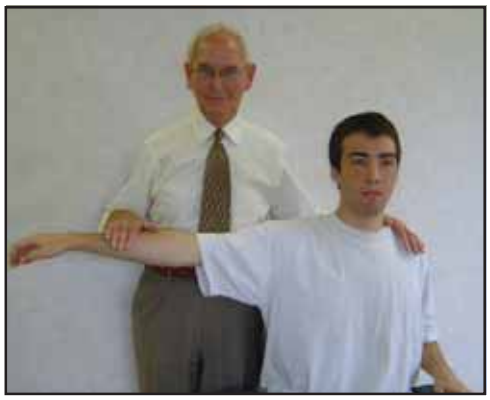

Figure 1a - Commonly used test in Applied Kinesiology for evaluating body function. Clinician is standing behind the subject for illustrative purposes. Normal position is in front the subject and facing him to observe reaction during the test.

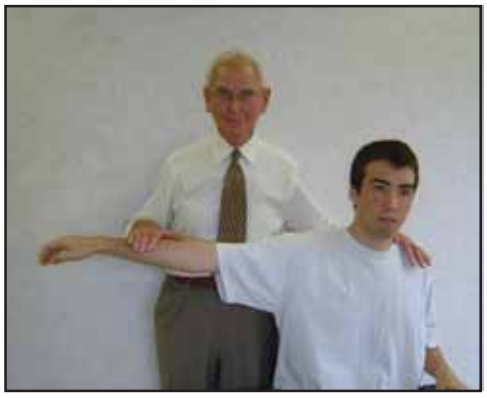

Figure 1b - Test is being repeated but the subject has changed his position. The head is tipped to the left and the left shoulder has dropped. In physical therapy terms, this is known as recruiting. The test is therefore not comparable with that in Fig. 1a. Strict protocol must be followed to ensure consistency of the test.

Breathing is relaxed, as before. If there is no weakening of the arm, this suggests that the mouth is probably not a primary etiological factor in causing any imbalance throughout the body. Very commonly, however, there is weakening of the muscle when the teeth are in light, full contact. When this is found, step three is to have the subject clench the teeth tightly and repeat the test exactly as before. In almost all instances, the result of this clenching will be a significant increase in muscle strength.

What is happening is that with the teeth in maximum intercuspation, *but not clenched*, there is an interference affecting the energy field of the whole body. This interference is caused by a shift of the mandible as it adapts to achieve maximum intercuspation. This is indicated by the weakened muscle reaction. By then clenching vigorously the individual overrides the imbalance introduced by the prematurity or mandibular displacement. The clenching causes flexion of the cranial base, which is a strengthening action. The body briefly harnesses the beneficial effects of forcefully putting the cranium into flexion. It is important to remember that the test is not really about the strength of the arm but is about the presence or absence of disturbance elsewhere in the body, in this case in the mouth.

Figure 2 Mandible has been advanced into an incisal edge-to-edge position during effort. Tongue is extended laterally to help maintain this.

Another common reaction in order to achieve maximum effort is for the individual to reposition the mandible while keeping the teeth in contact in some way other than in maximum intercuspation. The subject in Figure 2 has advanced the mandible into an incisal edge-to-edge position and is supporting this with a lateral extension of the tongue between the posterior teeth. For this patient to achieve maximum intercuspation of the teeth, the mandible has to be displaced distally. Both mandibular condyles are forced off the articular discs when this happens. There is reciprocal clicking present in both temporomandibular joints during opening and closing of the mouth. In order to achieve a maximum muscular effort, a forward position of the mandible is adopted. This serves both to permit the increased effort and also to protect the joints from pain.

In this particular subject, the edge-to-edge incisal position is actually an overcorrection. It can be demonstrated with the muscle test that as the mandible is moved back gradually from the incisal edge-to-edge position into full occlusion, there is a significant loss of strength at about the halfway mark in this slide. All the mandibular positions distal to this show a weakened response. Clinically, the mandibular condyles begin to come off the discs at about the halfway point. It is difficult to maintain a forward position of the mandible with no posterior dental contact and the mandibular incisors resting only on the lingual surfaces of the maxillary incisors. By advancing into the incisal edge-to-edge position the patient obtains a stable resting position. The tongue helps to maintain this position.

There is marked reluctance on the part of patients like this to go into maximum intercuspation. In doing so, they create an unfavorable disturbance in the electromagnetic field. This leads to a significant loss of muscle strength as a result. It explains the clinical

difficulty often encountered in trying to obtain a centric relation registration of the mandible. At a subconscious level, the body is aware of the unfavorable effect of the distal position of the mandible and tries to avoid this. These individuals do not solve their problem by clenching during effort as did the previous group. The anterior shift of the mandible offers an alternative solution and relieves the temporomandibular joints at the same time.

It is not uncommon for patients to work out some way of keeping themselves comfortable. In Figures 3a and b two patients are shown who have learned to place chewing gum between the teeth to act as a wedge. This helps to stabilize the mandible and to decompress the temporomandibular joints. When a patient admits to a regular habit of gum chewing, a distinction should be made as to whether this actually involves a constant movement of the mandible, which helps to remove any buildup of lactic acid in the masticatory muscles, or whether the gum is propped between the teeth and kept there as a cushion, as these patients do.

In the subject in Figures 4a and b, there has been intrusion of the maxillary left central and lateral incisors. The history is of the patient having been employed for the previous two years in an occupation where she was frequently required to lift heavy objects. Intrusion of the teeth developed over this period. The patient was well aware that she positioned the mandible to the left to obtain maximum effort when lifting. Examination showed a reciprocal click in the right temporomandibular joint, but there were no signs or symptoms of temporomandibular joint dysfunction otherwise. She presented with a request to have her teeth realigned. Attempting to do so without identifying the underlying etiology, and addressing this, would almost certainly lead to a relapse of any orthodontic intervention. Her adoptive position brings the right condyle anteriorly and to the left, thus temporarily bringing it onto the articular disc. This in turn allows her to achieve maximum effort. As with the previous patient, (Fig. 2), this repositioning avoids any joint discomfort.

The subjects shown in Figures 2 and 4 have an obvious displacement of the mandible. In many cases, any repositioning is much less noticeable than this. Careful examination may be required to identify if it occurs. The smallness of these spontaneous adjustments during effort indicates how subtle the role of the mouth can be. Articulator- mounted models in centric relation may be needed to identify any such minor shift. Faceting of the teeth can indicate where there is an initial contact causing the mandible to be deflected. Muscle testing has proven to be a valuable

Figure 3a, b - Examples of subjects using chewing gum as a way of maintaining a more favorable position of the mandible Gum is kept between the teeth rather than chewed constantly.

Figure 4a, b - Intrusion of maxillary left central and lateral incisors caused by patient posturing the mandible to the left when lifting heavv objects. Right temporomandibular joint has distal placement of condyle in the fossa.

adjunct in identifying whether these minor shifts are significant from an overall health viewpoint or not. It introduces a whole new dimension of thinking about occlusal equilibration, an idea which will be examined in relation to temporomandibular joint dysfunction.

The last category of oral response to be described is characterized by the teeth being kept apart during effort. A wide variety of oral behavior falls into this group. In Figure 5, the subject is biting her lip during effort, a common habit. She has a hyperflexion[25] cranial strain which predisposes to a Class II, Division 2 type of malocclusion. The action of the lower lip is not just to separate the teeth, but to exert pressure against the lingual surfaces of the maxillary incisors, effectively countering the retruded position of the premaxilla which is characteristic of a Hyperflexion strain. In this strain there is antero-posterior shortening of the maxilla.

Occasionally an individual will demonstrate several solutions. The subject in Figure 6a has a left sidebend.[26] This involves a functional shift of the mandible to the left on closing the mouth resulting in this patient having a left lateral crossbite. She has consciously developed several compensating mechanisms. In Figure 6b she has an anterior tongue resting position. In Figure 6c there is a left lateral tongue resting position while in Figure 6d she has learned how to use a piece of chewing gum as a

Figure 5 - Lip biting during effort. There is a Class II div ii malocclusion (Hyperflexion in osteopathic terminology). Action of the lip is to direct force against the lingual of the maxillary incisors. This is a common way of providing leverage on the premaxilla.

stabilizing device. In each case the mandible is centered when in the adopted position.

As these examples show, there are many variations on ways to achieve maximum effort by using the mouth. It is interesting to see some of these variations in athletes. Any issue of a magazine such as *Sports Illustrated* will usually have several examples. In particular, golfers, baseball pitchers and batters will frequently show oral adaptation as they strive for top performance. In these sports the athlete has time to position the mandible and the oral soft tissues to gain maximum leverage. The mouth is being used to ensure a balanced flow of energy through the body.

Figure 6a, b, c, d. - 6a shows the teeth in maximum intercuspation. In 6b, there is an anterior tongue resting position. In 6c, the tongue has a unilateral resting position. 6d shows how the subject has learned to use chewing gum as a prop. In each case the mandible has been centered, enabling maximum muscle effort to be made.

One development has been the use of mouthguards or splints to enhance athletic performance.[27, 28, 29] Properly fitted, with an understanding of the need to identify the position of maximum advantage, these devices can be effective. However, not every athlete benefits from wearing one. In some cases the mouthguard may create interference if it is placed in an athlete whose mouth is already well balanced. It follows that fitting mouthguards for a whole team does not guarantee an improvement in performance for every player. Selection on an individual basis is essential.[28]

The adaptations of oral behavior which have been described are so commonplace that we have failed to realize their significance. They are essentially physiologic compensations and are not necessarily indicative of any pathology. No action at all may be needed. However, this conclusion should only be reached after a thorough evaluation of the patient's history and the whole stomatognathic system. For example, the subjects illustrated in Figures 2 and 4 both presented with conditions of ongoing deterioration which required treatment. Clinical judgement has to be used with the understanding that as dentists or orthodontists, what we do in the mouth has wider consequences than we realize.

CONCLUSIONS

The first part of this article outlines the advances in physics and biology which require us to change how we think about the body. The second part extends this new perspective to include the mouth. Here also we have to change our thinking. The body, as a self-regulating system, learned long ago how to adapt oral behavior for mechanical advantage. We need to study these anomalies and learn to plan our treatment so as to work with the body, not against it. As dentists or orthodontists we proceed about our business of tooth repair or cosmetic improvement without fully appreciating the wider consequences of our intervention. The new, more comprehensive view of oral biology which is emerging offers exciting and challenging possibilities for change, especially in orthodontics. These changes have a direct bearing on some long-term problems in orthodontic diagnosis and treatment, bringing a fresh perspective to them.

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