

Orthodontics in a Quantum World I: The Rationale for a New Approach

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Abstract: *Advances in physics and cell biology are changing how science views studies about the body. The first part of the article is an overview of these advances. The second part is a working hypothesis as to how these changes could affect orthodontic diagnosis and treatment. An example is given of how this thinking might apply.*

One of the most difficult tasks any scientific community has to accomplish is what Kuhn¹ has called a paradigm shift. He has shown that new knowledge is absorbed in one of two ways. The most common is by a gradual incremental process, a filling-in of gaps within the overall framework of ideas and methods (the paradigm) held in common by the community. By its very nature, this type of research is designed not to question the general premises on which the group has agreed. This is an essential part of the scientific method and most research falls into this category.

The second process, the paradigm shift, creates much more controversy since it challenges the status quo. The new ideas cannot be fitted into the existing framework. Eventually, however, if they have validity, they are accepted and a new paradigm emerges. There are two criteria for this to happen. The new paradigm must explain known facts better than the old one. Secondly, it must take into account facts which were ignored, dismissed or simply not recognized by the old paradigm.

The first part of this article gives an overview of several well-documented advances in scientific thinking about biological systems. The second part of the article outlines a tentative hypothesis as to how these new ideas might affect dentistry and orthodontics. Subsequent articles will discuss the clinical implications of these ideas and also provide evidence to support the hypothesis.

Specific references to a number of texts are provided throughout, but a good general summary of recent developments is by Capra,² a physicist with a long-standing interest^{3, 4} in the links between physics and biology. To a large extent, it has been the work of physicists and cell biologists which has been

instrumental in creating the paradigm shift he describes. With a few exceptions,^{5, 6, 7} these innovative ideas have not evolved from within conventional medical research.

One new area of knowledge is based on the work of osteopathic physicians. They have described and documented a rhythmic movement of the brain and the cranial bones which continues throughout life.^{8, 9, 10} They have also identified that distortions or strains within the cranial base can occur which result in various cranial and facial adaptations. The dental and orthodontic consequences of these findings have already been reported in depth in a previous series of articles.¹¹⁻¹⁹ This one area alone presents a considerable challenge to conventional orthodontic thinking about diagnosis and treatment.

A second area of change is awareness of the electromagnetic field's role in the study of biology. The response to an electrical impulse along a nerve has been understood and studied for many years. The piezoelectric effect has also been recognized,²⁰ i.e. the change in electrical potential around a bone under load, which triggers its adaptation to an altered stress. A third effect has been identified by Becker,^{5, 6} an orthopaedic surgeon. This is the presence of a low level of direct current which is conveyed along the perineural sheaths of nerves. This plays a major role in wound healing and tissue regeneration.

The most dramatic new findings about electrical activity arise from the application of quantum physics to biology. It is now widely understood that at the atomic level there is vibration or resonance.^{5, 7, 21, 22, 23, 32} The laws of quantum physics apply at this level, not those of Newtonian mechanics and thermodynamics. Lipton²⁴ stresses that "the newer laws of quantum physics do not negate the results of classical physics,

but there is a need for a biology which integrates both quantum and Newtonian mechanics.” There is also general agreement that “there is electromagnetic communication at the molecular level which can account for a rapid, subtle and integrated functioning of living systems.”²³ This communication occurs at extremely low frequencies (less than 100 Hz).^{22, 23} There is considerable variation in the sensitivity of cells to these low frequencies.⁵

This new appreciation of electromagnetic activity and the significance of resonance as applied to biological systems leads to another major shift in thinking. We need to view the body differently and change our investigation techniques. Since the time of Descartes,²⁵ the body has been compared to a machine. By breaking it down into its separate parts and studying these in ever more detail, there is the belief that eventually we will arrive at a full understanding of the whole mechanism. It is considered that the organism is too complex to be studied as a whole. This process, known as reductionism, has worked well in many fields of science. It is still the favored method of approach in medicine. One example is the Genome Project with its assumption that the fundamentals of living systems will be found in some combination of genes.

There is a major problem in applying the reductionist approach to biological structures. In the process of preparing a living organism to a state where it can be examined, it will usually be killed before being decalcified, sliced, stained or subjected to some other form of preparation. In this process, a crucial component is lost. “Something has to be added to the laws of physics and chemistry before biological phenomena can be understood.”²⁶

The difficulty has been in how to account for the missing part of this process without invoking the presence of some mysterious external force or subtle energy (vitalism). This difficulty was recognized by physicists as long ago as the 1940’s.²⁷ In 1968, Bertalanffy²⁸ proposed what is known as the General System Theory. This has since been developed much more fully and has given rise to new fields of scientific investigation.^{29, 30, 31, 32} The essential point is that two distinct phenomena exist. One type, known as a closed system, describes non-living systems in which only the laws of Newtonian physics and chemistry apply. In these systems there is a gradual loss of energy (entropy) and a breakdown of complex mechanisms to simpler ones with increasing disorder. With the loss of energy there is a return to a stable equilibrium. A reaction can be traced in a linear sequence, i.e. there is a direct cause and effect that can be established.

Open systems which include organisms, have a quite different set of characteristics. These include: rapid and efficient energy transfer with minimal loss of energy, the ability to create energy at a greater rate than it is lost (negative entropy), the ability to evolve towards increasing differentiation and organization, long-range development and coordination and extreme sensitivity to initial conditions. Another feature of great importance is that of self-regulation. Prigogine,³² a Nobel Prize winning physicist, describes open systems as “non-linear, complex, dynamic, self-regulating systems far from equilibrium.” Such systems can only give probabilities of outcome, not certainties. **Perhaps the biggest single difficulty we experience in making a paradigm shift is that our way of thinking and our investigative methods are appropriate for non-living (closed) systems.** They can be quite inappropriate when applied to living (open) systems.

The problem for the clinician is in applying this new information in a meaningful way at a clinical level. What is needed is to recognize the realities of rhythmic cranial movement, tissue resonance, and rapid electromagnetic communication throughout the body as integrated components of an open system. Still,³³ the founder of osteopathy, stated more than 100 years ago that the body is self-adjusting, self-correcting and self-healing. In doing so, he was reiterating a belief which has been central to the healing arts in many different cultures for thousands of years. This belief considers that the healer’s primary role is in working with the body’s innate capacity to heal itself. This idea in my opinion has to a large extent been lost in current Western medical practice. The capacity for self-healing can give the body remarkable powers of recovery. Physicists talk of self-regulation which they see as an essential quality of open systems. It is this capacity for self-healing or self-regulation which can provide the basis for a new paradigm.

In the language of physics, the body is far from being in equilibrium. It may be stable, but it can only maintain this stability by a constant ongoing process of adjustment and self-regulation. The proposed hypothesis argues that the mouth plays a very significant role in this maintenance process. This requires thinking of the mouth as serving physiological needs, in addition to the obvious ones of airway maintenance, food intake and speech. The mouth provides a highly flexible and well-innervated means for the body to apply stimulative or corrective forces to processes both outside and within the stomatognathic system. Some examples are:

- stimulation or enhancement of rhythmic cranial movement

- attempts to correct mechanical stresses created by the various cranial strains
- compensatory adjustments for postural and balance problems
- positioning of the tongue and/or mandible to relieve pain from muscles or the temporomandibular joints
- as a lever to achieve maximum muscle effort throughout the body.

Most of the oral behaviors involved in these examples are classified loosely as parafunction. The dental literature is excellent in describing parafunctional behaviors but is speculative as to causes.³⁴ Okeson³⁵ emphasizes the psychological factors which can be contributory. Patients themselves are often aware of this aspect. There is no doubt that psychological stress can be a factor in dental imbalance. Selye,³⁶ a world authority on stress, discussed this in his introduction to Fonder's *The Dental Physician*.³⁷ However, it is argued here that the disruption of normal function introduced by various mechanical causes is the major contributor. The key is to identify what advantage is gained by any particular parafunctional behavior. Even parafunction which results in pain and tissue destruction can make sense if there is some gain elsewhere in the body. The following is an example of how this thinking could apply.

Thumb or finger sucking is normally a residual habit continuing from early childhood. In many children it ceases spontaneously at around three to six years. When it does persist, it is seen as a relatively minor problem and may be treated by the family dentist or a paediatric dentist. Two leading textbooks on orthodontics^{38, 39} do not even mention the problem. Suggestions as to why the habit persists have included; too short a period of breast-feeding, or psychological factors such as the child having to cope with the birth of a younger sibling. In contrast, the present hypothesis argues that the primary cause is probably mechanical and represents a subconscious attempt to alleviate stresses introduced by a cranial strain.

Figure (1) is taken from an osteopathic text.⁸ It shows application of light pressure from the therapist's finger to the posterior part of the palate, through the vomer to the sphenoid bone. This particular technique is used in the correction of what is known as a hyperflexion strain.¹³ It was this diagram which

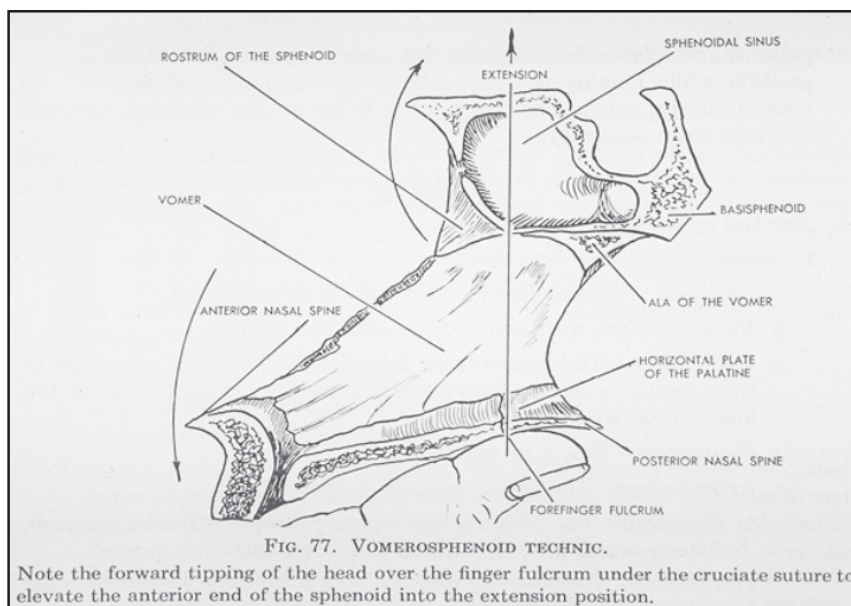


Figure 1- Diagram of osteopathic technique to rotate the sphenoid bone by means of finger pressure on the palate. Reprinted from *Osteopathy in the Cranial Field*, 2nd Ed. by Magoun, H.I. 1976, with permission from Dr. H.I. Magoun Jr.



Figure 2 - Patient A.M., 9 year old male with Class II, div I malocclusion. Underlying cranial pattern is an inferior vertical strain.¹⁵ First finger presses against the anterior slope of the palate, pulling the maxilla anteriorly.

prompted the thought that finger or thumb sucking could represent a subconscious attempt to correct an underlying cranial strain. How the individual sucks their thumb or finger might indicate what form of strain was present.

Several pieces of clinical experience reinforced this idea. Two young patients had been seen previously whose parents insisted their thumb sucking began several years after birth. One did so at three years and the other at four years of age. In each case, there had been significant trauma to the head in the months prior to the onset of the habit. This raised the possibility that the habit was indeed corrective following the trauma. Secondly, when patients were referred for an osteopathic evaluation prior to dental intervention, the therapists routinely reported that cranial movement was stronger and more easily palpated with the patient's thumb or finger in the mouth, than with it out.

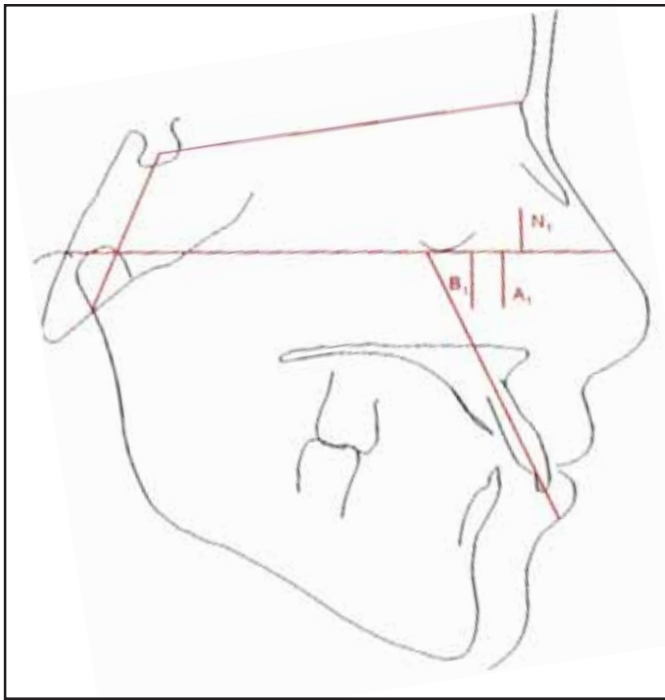


Figure 3 - Tracing of Lateral skull radiograph of Patient A.M. Nasion, point A and point B have been projected onto the Frankfort Plane at right angles. Nasion lies 4mm behind Pt. A. (average distance of Pt. A from Na is ± 2 mm).

Figure 4 - Patient J.T., 15 year old female. Malocclusion is Class I on the right and Class II on the left. Cranial strain is a left side-bend¹⁷. Mandible is centered, with the finger acting as a stabilizer. Right hand exerts upward pressure.



Finally, in a number of cases where the habit was mild, e.g. night only, there was spontaneous cessation of the habit after osteopathic adjustment, but before any dental treatment was begun. This occurred so frequently that it became standard procedure for any patient with a digit sucking pattern to be referred to the osteopath before commencing orthodontic treatment. This also had the advantage of a cranial evaluation being given by a colleague in another health discipline.

Two cases are shown to illustrate this concept. Patient A.M., (Fig. 2) has a Class II, division I malocclusion. In osteopathic terms he has an inferior vertical strain. The facial and dental picture associated with this strain has been described in detail

previously.¹⁵ As McNamara³⁸ has pointed out, almost 25% of Class II division I patients actually have retrusion of the maxilla, although this is usually masked by the proclination of the incisors. Patient A.M. shows the narrow facial features, flaring of the ears and flattening of the malar processes together with a high narrow palate, all of which are commonly found in the inferior vertical strain pattern. This characterizes a maxillary retrusion. Figure 3 shows a tracing of the lateral skull radiograph for Patient A.M. Nasion, point A and point B are projected onto the Frankfort plane at right angles to it. When this is done, Point A lies 4mm behind Nasion. As the average variable is ± 2 mm in the Nasion to Point A relationship, this would support the view that there is a maxillary retrusion in this individual, as the facial features would indicate. His finger is actually pressed against the anterior slope of the palate, effectively pulling the maxilla forward.

Patient J.T. (Fig. 4) has a quite different strain, known as a left side-bend. Dentally, it presents as an asymmetrical malocclusion, being Class I on the right side and Class II on the left. This strain in particular is of great interest from an orthodontic aspect.^{17, 18} Two features are that the ocular plane runs down to the left, while the lateral occlusal plane (plane of Wilson) runs up to the left, i.e. they converge on the left side of the face. The mandible displaces to the left when the teeth are in maximum intercuspation. The patient is 15 years old and still has persistence of her habit. She also complains of early temporomandibular joint discomfort and frequent suboccipital headaches, but reports that her habit gives her some degree of relief. She is applying an upward pressure on the right side of the face, but centers the mandible and uses the left finger as a cushion to help maintain mandibular position. Her centerlines are coincident with the finger in place. As with the previous patient, the habit appears to be self-correcting for the cranial strain. In this case it also helps to minimize discomfort. Orthodontic treatment for both patients was planned recognizing the presence of the underlying cranial pattern.^{15, 17, 18}

In both cases, osteopathic treatment was begun before orthodontic intervention. This did not result in cessation of the habit, but, this was not considered likely for these particular individuals. The osteopathic evaluation confirmed the diagnosis of the cranial strain patterns. Patient J.T. did experience a sharp decrease in the severity and frequency of her headaches.

Orthodontic treatment was not begun with the heavy wire, fixed type of appliance which was used prior to an understanding of cranial movement. These appliances tend to aggravate the problem, not relieve it. The Advanced Lightwire Functional (ALF) appliances

suitable for the particular strains were used.^{15, 18} The habit came under control in approximately two months for Patient A.M. and in three weeks for Patient J.T.

Other examples of parafunctional behavior and how these might have a physiological basis will be presented in the next article. However, the hypothesis of the body as an open system offers far more than just an explanation for parafunction. Any intervention in the mouth may have an effect outside the mouth. While this is often temporary, a whole range of dental procedures may inadvertently create imbalance elsewhere in the body. To some extent, it is possible to identify these and make the necessary adaptation before finalizing the procedure.

The timing of orthodontic treatment needs to be reassessed because open systems have great sensitivity to initial conditions. This is due to their self-regulating quality which means that a small variation early in development results in a much larger variation at a later point. At least one researcher⁴⁰ is currently reporting on the effects of orthodontic intervention in children less than six years of age. This may well help resolve the long-standing debate over the merits of early treatment.

As was mentioned in the previous series of articles, the level of force used in orthodontics and how that force is applied must be reconsidered. **The existence of an almost instant electromagnetic communication system throughout the body provides a way of asking the body what level of force is appropriate.** Currently, this is decided empirically by the clinician based on clinical experience and to some extent on how much discomfort the patient will tolerate.

These are only a few of the areas where the proposed hypothesis indicates the need to think afresh. As a new paradigm is developed, more members of the scientific community focus on its implications. This leads to revision and modification of the original hypothesis. New and unexpected directions will open up. Over the next several articles the ideas outlined in this paper will be developed. However, it is recognized that this is only a starting point.

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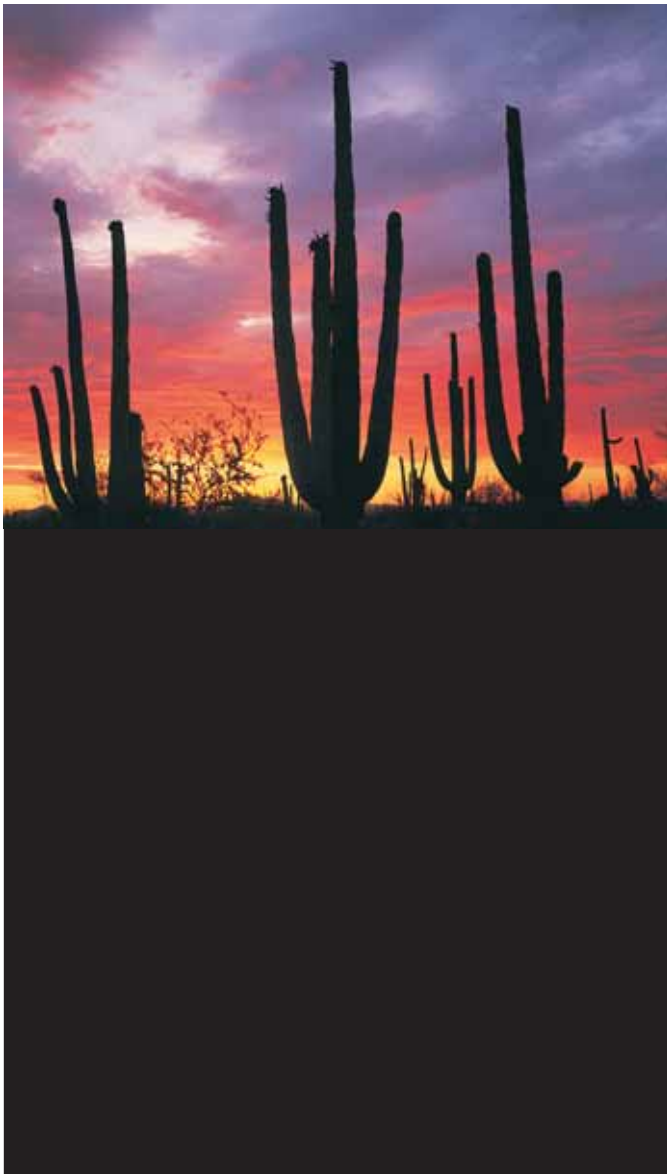
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