

Feature

An Introduction to Cranial Movement and Orthodontics

This article has been peer reviewed.

By: Gavin A. James, M.D.S., F.D.S. and Dennis Strokon, DDS

In our recent article (*International Journal of Orthodontics*, Fall 2003), we presented evidence for the idea of cranial movement and suggested that this was associated with malocclusion. Such an idea is a radical departure from current orthodontic thinking and it is tempting to dismiss the concept as irrelevant. However, the framework of ideas and methods, which have evolved from the cranial concept, is of fundamental importance to orthodontics and indeed to dentistry. A summary of the principles underlying this new philosophy appears in the box below.

By invitation of the Editor, we propose to develop these ideas in a series of articles. In these articles the cranial, facial and postural characteristics of each strain are described together with the malocclusion which results from this. The adaptive and functional behavior, which usually develops, is also discussed with particular emphasis on temporomandibular joint dysfunction. This is followed by a rationale for treatment, which recognizes the combination

of factors contributing to the malocclusion.

The timing of treatment is reassessed in the light of cranial movement and new work in the field of complexity and chaos theory. Finally, the implications of resonance and electromagnetic field theory with regard to the force systems used in orthodontics is examined.

This is an ambitious and controversial undertaking. As Kuhn¹ has pointed out, for a scientific community to change the ideas and methods which it holds in common, i.e., its paradigm, can be a painful and slow process. However, if the new paradigm offers a better explanation of known facts and can also take into account facts which have been ignored or dismissed under the old paradigm, then eventually the community accepts it. Good science requires that we be prepared to change our minds if evidence can be shown to call for this. It is our hope that we can provide this evidence.

Since the series will extend over time, readers might

1. Rhythmic movement of the cranium is a physiological characteristic throughout life. This movement is transmitted to the whole body and in particular to the facial structures.
2. Distortions of the cranial structures can occur, especially during the birth process, but also due to subsequent trauma. Once formed, these distortions can be reinforced by soft tissue adaptation. Faulty swallowing patterns can perpetuate the distortion.
3. These distortions or strains, to use the osteopathic term, fall into two categories: (a) as an exaggeration of physiological movement (Hyperflexion, Hyperextension, Superior Vertical Strain, Inferior Vertical Strain) or (b) as disturbances along an anteroposterior axis (Torsion, Sidebend, Lateral Strains).
4. Each cranial strain predisposes towards a type of malocclusion. The importance of the airway, swallowing patterns, tongue position and hereditary factors, etc., is acknowledged, but an understanding of cranial distortions puts these factors into perspective.
5. Malocclusion must be seen as an integral part of the total body picture. Using this approach provides a much more individual and sophisticated diagnosis. Treatment planning begins with the identification of cranial strains. Treatment then is aimed at resolving the cranial factors as far as possible, then correcting the maxilla and maxillary dentition, then addressing the mandibular arch.
6. Given the reality of cranial movement, the forces used in orthodontics must be designed to correlate with or enhance the cranial rhythm and not overwhelm it. In practice, this means a much more subtle application of force designed to stimulate the innate capacity of the body to self-adjust and self-correct.
7. The existence of cranial movement as a naturally occurring phenomenon leads to identification of a fundamental inconsistency in current orthodontic thinking, namely, that with the application of Newtonian mechanics we can expect a predictable linear response consistent with Newtonian principles. This may not be the case because a complex dynamic system such as the human body may not react in this way.
8. Current thinking in physics and biology offers a radically different approach which incorporates cranial concepts and which validates the above statement.
9. The anatomical and physiological basis for this new approach is presented together with clinical evidence of its efficacy.

find it useful to consult the DVD made of our presentation at the IAO Convention in Savannah, Georgia, in April of 2004.² The DVD gives an overview of the whole concept and is available at www.dubking.com. The articles will allow us to develop the ideas in depth.

Hyperflexion and Hyperextension: A Comparison

In our previous article we outlined the pattern of rhythmic movement of the cranium and we touched on the phenomenon of cranial distortion or strain which may develop. The challenge for the dentist is to understand how this distortion of the cranial base structures can relate to malocclusion.

The availability of the lateral skull radiograph has encouraged many attempts to identify various features of the cranial base that might influence facial structures. These have recently been reviewed by Andrea et al.³ Most cephalometric analyses incorporate various parts of cranial base structures into their evaluation or use them for superimposition purposes, but this is of limited value in diagnosis.

The most interesting attempt to correlate cranial form with facial and dental features is that described by Enlow and Hans.⁴ They use the Cephalic Index, an anthropological technique for measuring skulls. This gives rise to the familiar grouping of dolichocephalic (long head), brachycephalic (broad head), and mesocephalic (intermediate head). This classification holds up in broad ethnic terms,⁵ but as Enlow et al readily point out, there are wide variations within each group. While the Cephalic Index has merit in identifying ethnic variations, there are serious problems in attempting to use it as a basis for understanding malocclusion. **The purpose of any classification should be to clarify a subject and thereby assist the clinician in his approach to diagnosis and treatment.** Unfortunately, the use of the Cephalic Index can lead to complex and at times contradictory conclusions when applied to malocclusion.

In contrast, the classification developed by the osteopathic profession has proved to be very practical from several aspects. It pinpoints the underlying etiology of the cranial/facial variations. It explains the presence of asymmetries, which are present in every individual. It enables a highly specific diagnosis to be made for each patient. It provides a systematic approach to treatment planning by recognizing the contribution made by the cranial structures.

The brilliance of Sutherland's achievement⁶ was not just to recognize that the skull moves but that the key to identifying craniofacial variation is the relationship between the sphenoid and the occiput. With this insight the relevance of the cranial base to malocclusion can be understood.

Essentially, we are changing our focus away from diagnosing and categorizing the arrangement of teeth within the oral cavity. Think instead of describing the dental structures as components within the entire cranium, responding to differences in the overall morphogenetic pattern.

In this sense teeth are riders on a system, responding to variations throughout the articulations of cranial and facial bones. At the centre of the variable dynamic system of bones and sutural movement is the sphenoid-occipital articulation. In osteopathic literature this is known as the sphenobasilar symphysis (S.B.S.). The articulation is not the cause of the problem but is a reference point to describe the variations in skull formation types. This articulation in the skull acts as a stress breaker, where a shift or adjustment can occur in order to accommodate strain in the overall system, comparable to the action of the keel of a ship.

In order to demonstrate this process we have, in this article, combined an initial examination of the first two of the seven cranial strains to be discussed in this series. By comparing them side by side, the dramatic contrast highlights the need to understand and include the characteristics of the various strains in our observation of patients.

The flexion/extension movement of the cranium centers in the sphenobasilar symphysis. A common pattern of distortion or strain is where there has been an exaggerated movement into either flexion or extension and this becomes a persistent feature (Diagrams 1 and 2). **These strains are called hyperflexion and hyperextension. While there may be a hereditary component they can also develop during the birth process.** They may even be imposed in utero or by trauma subsequent to birth.⁷ Accompanying each strain pattern is a characteristic group of cranial, facial, dental and postural features.

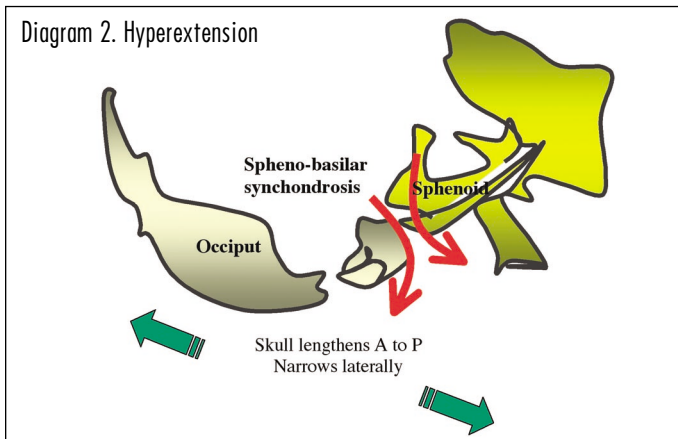
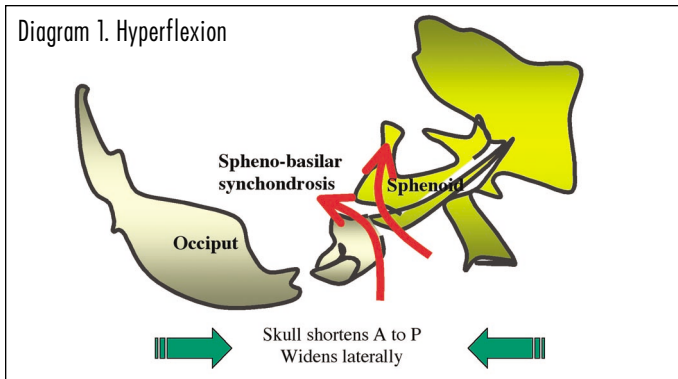
Figures 1 and 2 show full-face and profile views of representative hyperflexion and hyperextension individuals. These will now be discussed.

Full Face Characteristics

Cranial outline: In the hyperflexion example the lateral expansion of the skull has brought about a flattening of the cranium along the sagittal suture and a widening of the cranium laterally. In the hyperextension example the lateral contraction of the cranial bones leads to an elevation along the sagittal suture and a narrowing of the cranium.

Ears: As the skull expands laterally in hyperflexion, the squamous portion of the temporal bones rotate outwards. The effect of this is to carry the ears laterally giving the flared appearance seen in this individual. Since the axis of rotation around which the temporal bone rotates runs diagonally to the cranial mid-line, the glenoid fossae tend to move distally as the ears go laterally. This in turn carries the mandible distally. This feature will be discussed in more detail in the next article.

One ear may be more flared than the other. The more flared ear indicates that the temporal bone is more outwardly rotated on that side. The result is that the mandible is carried back more on that side and thus is displaced towards the more flared ear. This relationship of flared ear to distally displaced mandible is a consistent finding that can be applied as a diagnostic clue. It may occur unilaterally or bilaterally depending on the underlying strain pattern.



Variations such as one ear being higher than the other or placed more forward than the other on an anteroposterior plane will be discussed in relation to other strains. In the hyperextension example, the squamous parts of the temporal bones move inwards carrying the ears closer to the skull. The glenoid fossae are placed forward tending to give a prognathic mandible.

Mid-facial Features: The mid-face shows striking differences. The hyperflexion example has a wide face with well-developed malar processes; the eyes are set wide apart and the nares are also wide. In the hyperextension example the mid-face is obviously constricted while the malar processes and the lower borders of the bony orbits are retruded. This gives a mid-facial flatness or even a concave mid-face. The eyes are close together and the nares are constricted. The maxillae are carried up and back due to the greater wings of the sphenoid rotating upward and backwards. There may be constriction of the nasal airway as there is in this individual.

Lower Face: In the hyperflexion example there is a reduced lower facial height. There is a rolled contour of the lower lip. In the hyperextension individual there is an increase in lower face height tending toward an open bite of skeletal origin. Lips may be apart at rest due to the increased height of the lower face.

Profile: The contrast in facial features between these two cranial strains is also apparent in profile view. Taken as a whole, the hyperflexion head is shortened in an A-P plane and the posterior cranial outline is more vertical. The hyperextension head is elongated from the posterior upper outline down towards the mandible. The mandibular retrusion is obvious in the hyperflexion example, as is the mandibular prognathism in the hyperextension example. This appearance of mandibular prognathism is increased by the maxillae also being drawn upward and backward.

We have deliberately delayed discussing the malocclusions accompanying these two strains. This is to shift priorities away from identifying the Angle classification as the initial step in diagnosis. The dental characteristics should be seen as a reflection of the craniofacial structures. Eventually, with experience, the Angle classification becomes almost redundant.

As readers may have anticipated, the hyperflexion individual has an Angle Class II, Division II malocclusion and the hyperextension subject has one type of Angle Class III malocclusion, with a high narrow palate and bilateral cross-bite. Both these craniofacial variations will be examined in more depth in following articles as to how they come about, how to recognize them and how to approach treatment.

Osteopaths diagnose the various cranial strains primarily by palpation of the cranium. Handoll,⁸ an osteopath, claims that the facial features cannot be used to determine cranial strains. However, after eight years of clinical application of facial evaluation we are confident that the visual

approach has validity. Many of the patients we have diagnosed in this way have also had an independent assessment by osteopaths. Their findings support our hypothesis.

A reasonable question is why we should make the effort to understand the range of cranial strains which can occur. It is not just a matter of learning osteopathic terminology. It involves a major shift in almost every aspect of orthodontic diagnosis and treatment. The reward is to reach a far more penetrating understanding of how a malocclusion develops. This understanding leads to a radical change in treatment objectives and in the choice and delivery of force systems. This results in more effective and long lasting benefits in our patients' overall health, not just the correction of their malocclusion.

References

1. Kuhn, T.S., *The Structure of Scientific Revolutions*, 2nd Edition, University of Chicago Press, 1970.
2. Obtainable from Dubking Conference Videos, Telephone: (210) 979-8779 or E-mail: www.dubking.com.
3. Andrea L., Leite L., Prevatter T., King L. "Correlation of the Cranial Base Angle and its Components with other Dental/Skeletal Variables and Treatment Time." *Angle Orthodont.* 74 361-366, 2004.
4. Enlow D.H., Hans, M.G. *Essentials of Facial Growth*. Pub. W. B. Saunders Co., 1996.
5. Kuroe K., Rosas A. Molleson T. "Variations in Cranial Base Orientation and Facial Skeleton in Dry Skull Samples from Three Major Populations." *Europ. J. Orthodont.* 26: 201-207, 2004.
6. Magoun H.I. *Osteopathy in the Cranial Field*. 3rd Ed. 1976. Available from Sutherland Teaching Foundation, 4116 Hartwood Drive Fort Worth TX 76109.
7. Frymann V.M. *Collected Papers 1998*. Ed. By H.H. King for the Amer. Acad. Osteopathy, 3500 DePauw Blvd. Suite 1080 Indianapolis IN 46268-1136.
8. Handoll N. *The Anatomy of Potency*. Osteopathic Supplies Ltd. 2000. Distributed in North America by Stillness Press L.L.C. Tel. (503) 265-5002

ORTHODONTIC TECHNOLOGIES, INC.

Your Partner in Successful Treatment

Diagnostic Services & Assistance

- Professional Study Models
- Cephalometric Tracing
- Computerized Analysis
- Appliance Design Specialists

Customized RX™ Services

- Interceptive / Phase I
- Comprehensive / Phase II
- TMD
- Indirect Bracketing
- Retention
- **WILD THINGS** Custom Acrylic

Contact us for laboratory supplies or appliance assistance.

1-800-346-5133

email: otinfo@orthodontictechnologies.com

713-861-0033 ● Fax 713-861-1722

5524 Cornish ● Houston, Texas 77007-4304



Gavin A. James, MDS, FDS

Dr. James is an Orthodontic Specialist in Barrie, Ontario. A major part of his practice is concerned with the management of temporomandibular joint and craniomandibular disorders. His interest in cranial movement has developed as a part of a more comprehensive examination of the problem of head and neck pain.



Dennis Strokon, DDS

Dr. Strokon is a general dentist in Ottawa, Ontario. He received his dental degree from the University of Western Ontario in 1972. For the past twenty-five years he has taken an interest in treating symptomatic patients using both restorative and orthodontic techniques in his practice. Dr. Strokon and Dr. James lecture on the philosophy, treatment concepts and design of the ALF appliance.