Cranial osteopathy and craniosacral therapy: current opinions

A. J. Ferguson, J. M. McPartland, J. E. Upledger, M. Collins, R. Lever

A. J. Ferguson DO (Hons) MRO
15 Pembridge Road,
Notting Hill,
London W11 3HG, UK

Correspondence to: A. J. Ferguson;
Tel: + 44 171 937 2298; 171 727 7733

Received July 1997
Accepted July 1997

Journal of Bodywork and Movement Therapies (1998)
2(1), 28–37

INTRODUCTION

A. J. Ferguson

Since the publication of *The Cranial Bowl* by William Sutherland DO in Minnesota in 1939 there has been considerable controversy within the osteopathic profession as to the existence of what he called the 'primary respiratory mechanism', and if it does exist then what are the physiological processes behind it. In the past 20 years Sutherland's hypothesis and practice have also been taught to non-osteopaths under the name of Craniosacral therapy, principally by Dr John Upledger DO and the Upledger Institute in Florida.

Nearly 60 years later the debate continues and, despite improvements in the understanding of human physiology, the teaching of cranial osteopathy has hardly changed. *JBMT* considered that now was a good time to ask two osteopaths in the USA, Drs Upledger and John McPartland, and two in the UK, Robert Lever and Dr Martin Collins to give their views in the light of contemporary knowledge. Each osteopath has studied and experienced the cranial phenomenon, so there are no strong contrary opinions as to its existence; rather these are individual explanations of it. Each was given the same five questions to answer in their own words and their answers are printed here for readers to form their own ideas. The questions are:

1. If you were William Sutherland DO and had made his observations about the arrangement of cranial articulations and had felt what appeared to be subtle movement within the cranium and throughout the body, what would your explanation be for these phenomena in the light of current knowledge?
2. Is it possible that palpable motion occurs at the sphenobasilar junction after it has fused by the early twenties?
3. Does there exist an objective cranial rhythmic impulse, is it palpable or measurable and, if so, what rate per minute do you feel?
4. Is sacral motion synchronized with cranial motion? If so, by what means? What do you consider is the role of the spinal dural membrane in this process?
5. Which specific areas of research or experimentation do you feel should be carried out now to support your hypotheses or throw more light on this subject?

#1998.01D

J. M. McPartland

Question 1

If William Sutherland were alive today, he would be listening to reggae music. He would be aware of syncopated polyrhythms. This would have influenced his thoughts regarding the source of the cranial rhythmic impulse (CRI).

Of course, Sutherland did not use the term 'cranial rhythmic impulse'. The term was coined by John and Rachel Woods, 7 years after Sutherland died. Sutherland described the 'primary respiratory mechanism'. He proposed that this motion was generated by rhythmical brain movement within the skull, causing dilation and contraction of cerebral ventricles. This pumping action of the ventricles generated a pulse wave of cerebrospinal fluid (CSF), which transferred movement to the reciprocal tension membrane and dural meninges, causing movement from the cranium down to the sacrum (Sutherland 1990).

But what is the source of brain motility? Sutherland (1939) suggested a chemical–electrical source, citing Dwight Kenney DO: 'The brain is now known to be a powerhouse, maintaining a rate of twelve pulsations a second. Each of the brain's millions of molecules is an electron dynamo ...'. Magoun (1976) elaborated on this hypothesis, suggesting that direct current carried within the brain creates an electrical or magnetic field, causing the neural tube to coil and uncoil cyclically as the field collects and discharges.

Alternatively, an oft-cited study (Lumsden & Pomerat 1951) explains that individual glial cells pulsate in vitro, and the summation of these pulsations translates into CRI. But glial cells pulsate at a completely different rhythm than CRI and they lack the tensile strength to form contractile tissue within the brain.

A third theory is based on hydraulics. Magoun (1976) suggested that rhythmic variations in the production of CSF by the choroid plexus might contribute to brain motility. Upledger & Vredevoogd (1983) expanded the choroid plexus hypothesis with several secondary neurological and mechanical mechanisms. Their 'pressurestat' model surmises that CSF is produced in waves and this pulsation drives brain movement, a reversal of Sutherland's hypothesis.

In support of the pressurestat hypothesis, CSF fluctuations and rhythmic brain motility have been measured (Feinberg & Marks 1987). But these pulsations are much quicker than CRI and appear to be synchronous with cardiac systole. Ferguson (1991) criticized the pressurestat model, noting that there is no delay in CRI from head to foot as might be expected if CRI were generated in a fluid wave. He postulated that CRI is generated by extracranial muscles. Previously, Becker (1977) speculated that CRI is generated by extracranial muscles in the process of making moment-to-moment postural adjustments. Other extracranial sources of CRI have been hypothesized, such as cutaneous tissues (Norton 1991) or a total-body energy pattern (Kappler 1979).

Frymann (1971) was the first to consider polyrhythms as a source of CRI, 'In palpation, the fingertips are subjected to four cyclic motions of different frequency, one each from the pulse and the respiratory cycles of the operator and of the subject. It may be contended with some force of argument that the apparent sensation of a slow cranial rhythm represents only a 'beat' frequency between, say, the two pulse cycles'. But Frymann dismissed this hypothesis.

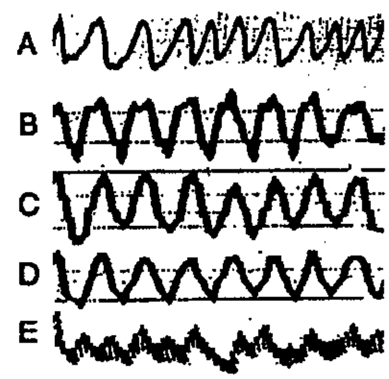

Fig. 1 Illustration of several body rhythms measured over 1 minute: **A**, the CRI, from Frymann (1971); **B**, diaphragmatic respiration, from Tiller et al (1996); **C**, heart rate variability, from Tiller et al (1996); **D**, pulse transit time, from Tiller et al (1996); **E**, Traube-Hering modulation, from Jenkins et al (1971). All original illustrations altered to fit a 1-minute y-axis of 5 cm.

Polyrhythms were re-addressed by Norton (1991). His 'tissue pressure model' proposed that CRI is a simple harmonic of four rhythms – the cardiovascular and respiratory oscillations of the patient and practitioner. Hence, CRI manifests in cutaneous tissues and is perceived by mechanoreceptors in the clinician's fingertips. Norton tested this model with a computer simulator, and produced patterns that resemble clinical CRI recordings by Frymann (1971). Norton found that CRI rhythms closely correlated with respiratory rhythms (Fig. 1A, B).

John M. McPartland DO MS
Alternative Medicine Research Institute & Teacher's Academy, 53 Washington Street, Middlebury, VT 05753, USA

Correspondence to: J.M. McPartland; Tel: + 1 802 388 0575

Received October 1997
Accepted November 1997

Journal of Bodywork and Movement Therapies (1998) 2(1), 29–31

McPartland & Mein (1997) take polyrhythms further. Their 'entrainment model' resonates with Norton's model – that CRI is a palpable harmonic frequency of multiple biological oscillators. The entrainment model merges respiratory oscillations and cardiovascular pulses, their calculus of variations, and then adds many other biological oscillations. Pulse rate is not the sole oscillating cardiovascular event that can be measured in the cranium: the pulse rate itself varies on a rhythmic beat-to-beat basis, on a scale of milliseconds (Tiller et al 1996). This is called heart rate variability (HRV), illustrated in Figure 1C. Oscillations in cerebral blood *velocity* have also been recorded, independent of systemic circulatory parameters (Diehl et al 1991). Oscillations have also been measured in cerebral blood volume (Vern et al 1988), and pulse transit time (Tiller et al 1996) illustrated in Figure 1D. Traube-Hering modulation (THM) is a change in blood pressure, which also varies, on a beat-to-beat basis. THM causes a sinusoidal fluctuation of brain volume, pulsating at a rate of 7 cycles/min (Jenkins et al 1971), illustrated in Figure 1E. Fluid pressure within lymphatic vessels also oscillates rhythmically, between 7.5 and 10 cycles/min, asynchronous with diaphragmatic respiration (Olszewski & Engest 1979). Glial cells pulsate (Lumsden & Pomerat 1951), cortical metabolism oscillates at 9 cycles/min (Vern et al 1988), autonomic nerves fire in synchronized patterns (Barman & Gebber 1976), and electrical fields generated by cortical neurones exhibit rhythmicity (Llinas 1993).

This complex of polyrhythms approaches a Fourier series – a potentially endless series of variables multiplied by wave functions. This complexity (and redundancy) explains how CRI can continue to be palpated while the patient holds a breath.

According to the entrainment model, 'palpation' may also be a harmonic of several senses. Most of the aforementioned biological oscillators transduce into tissue motion, such as fluid waves and muscle movements. These can be detected by the practitioner's hands via mechanoreceptors (Merkel's cells, Meissner's corpuscles, Ruffini's corpuscles, Pacinian corpuscles) and proprioceptors (muscle spindle fibres, Golgi tendon organs). Cutaneous temperature sensors also contribute signals from the site of palpation. Unelucidated sensors may detect brain waves, electrical or magnetic fields, piezoelectricity, or changes in 'body electricity', as described by yogic practitioners (Green 1983). As Magoun (1976) paraphrased Sutherland, 'This calls for thinking, seeing, feeling, knowing fingers...'

Question 2

Sutherland envisioned the sphenoid and occiput acting as two gears revolving on transverse axes. Their interdigitating cogs describe the mechanics of the sphenobasilar junction. He may not have known that the sphenobasilar junction fuses in most humans by the age of 20–25 years (Magoun 1976). Magoun more accurately described motion as *bone flexibility*, rather than *articular mobility*. Living bone is viscoelastic. It responds to loads (dural traction, compression, and twist) by bone deformation – movement described as strain and creep (Ward 1997). Thus, palpable motion occurs at the cranial base, but it develops along the length of each bone, not at the point of the sphenobasilar junction.

Question 3

According to entrainment theory, the CRI is a palpable summation signal, emitted from multiple biological oscillators. Many of these biological oscillators are influenced by autonomic nerve function. McCraty et al (1995) and Tiller et al (1996) describe a significant event arising in biological oscillators when sympathetic and parasympathetic systems become balanced. The body's myriad rhythms, including HRV, THM, respiration rate, pulse transit time and even brain waves, all coordinate into harmonics with each other (see examples in Fig.1). Together they form a primary, fundamental frequency, which McCraty termed the *entrainment frequency*. In healthy human subjects with balanced sympathetic and parasympathetic systems, the entrainment frequency has been measured at about 0.125 Hertz, or 7.5 cycles/min (McCraty et al 1995, Tiller et al 1996).

Dysfunction of the autonomic nervous system may change the entrainment frequency, causing perturbations in the CRI – altering its rate and amplitude (McPartland & Mein 1997). In the presence of severe dysfunction, the body's rhythms may not coordinate into harmonics, resulting in an undetectable CRI.

Question 4

CRI can be palpated anywhere on the body, as can its components – respiratory oscillations, cardiovascular pulses, HRV, THM, etc. One component, the oscillations of CSF volume produced by the choroid plexus, is most easily palpated in tissues adjacent to the dura. Some osteopaths claim that the CSF pulse is propagated as an instantaneous transmission of hydraulic pressure. Other osteopaths, and some MDs (Urayama 1994), describe the CSF pulse as a wave or tidal motion. Mitchell (1987) states that the CSF pulse is transmitted *both* ways – our CRI version of Einstein's 'particle-wave' principle of duality.

Question 5

We should experimentally determine if McCraty's entrainment frequency corresponds to the CRI rhythm. The CRI may not be the final, fundamental harmonic. Sutherland alluded to deeper, more subtle, harder-to-detect rhythms besides CRI (Sutherland 1990). His student, Rollin Becker, described 'the slow tide', oscillating with a frequency of 0.6 cycles/min (Becker 1994). James Jealous describes a third rhythm, which he simply calls the '21/2 CPM rate', with a frequency of 2.5 cycles/min (McPartland & Mein 1997).

We should also investigate the *modus operandi* of practitioners who bring about therapeutic changes in the CRI of their patients – perhaps 'healing' represents entrainment between individuals. Over 300 years ago, Christiaan Huygens noted that pendulum clocks with the same length pendulum began swinging in synchrony with each other (Strogatz & Stewart 1993). This coupling phenomenon is seen in synchronously flashing fireflies, harmoniously chirping crickets and women whose menstrual phases cycle together. Huygens noted that the 'strongest' clocks (those with the heaviest pendulums) establish the eventual, overall rhythm. Perhaps practitioners transfer their 'strong clock' harmonic rhythms onto their patients. Skilled practitioners enhance this transfer by assuming a meditative focus before treating patients. Empathetic, meditative, 'centred' states are known to produce strong entrainment (McCraty et al 1995, Tiller et al 1996). Practitioners can then influence, or 'pull' the patient's dysfunctional state towards a more balanced and harmonic state.

Dr J. E. Upledger

Question 1

I cannot be William Sutherland; however, I can be myself and perhaps project how I feel and react when I see things that are inexplicable by the body of knowledge at the time that such an inexplicable event is observed.

First, I believe that all things designed in Nature are for a reason. Thus, looking at the sutural design of the skull, be it human or otherwise, would indeed invite me to develop an array of ideas relating to why Nature made these designs as she did. I would consider motion as one possibility. This motion could be for more than one purpose. Certainly accommodation of the head to the birth canal is one. Another would be to accommodate the growth of the skull, brain, etc. from a newborn to a full grown adult. Yet another might be as a shock absorber design that limits the spread of fractures from a single site to the whole skull. Still another possibility is certainly that the skull and its sutures are designed as they are in order to accommodate some sort of physiological activity that is unknown at the present time. Our own current investigations suggest a pumping action that might help move red blood cells from the bone marrow into the vascular system.

I would then begin to explore the feasibility of all of these possibilities and at the same time keep my mind open for other possibilities as they might present themselves.

As I carried out my search, I assume then that I would feel with my hands a subtle rhythmical motion. As I trust my hands and the messages they give me, I would accept the idea that there is a physiological activity or system related to this motion that I feel. This would be an activity or system of which we have little or no understanding at this time. I would suspect that the sutural design was made in order to accommodate this motion.

This is probably where I would depart from many of my scientist friends. I believe that we offer a major disservice by prematurely developing an explanation for an observed phenomenon. I would continue to observe and make models that are very much subject to change as the breadth of observed activities continued. It is quite possible that I would change a model on a daily basis. I am quite content to report that something occurs, that it can be relied upon and made use of in any number of ways without my understanding how or why it works.

Fortunately for me, my first exposure to the craniosacral system was during a surgical procedure wherein the dural membrane was exposed and visible, and it was also kept intact. I saw the rise and fall of cerebrospinal fluid pressure and volume within the watertight compartment formed by the dural membrane. I saw the effect of these fluid dynamics first hand. Had I not seen this, I doubt that I would have become involved in the investigation of the skull, the spinal canal, the

John E. Upledger DO OMM
The Upledger Institute, Inc.,
11211 Prosperity Farms Road,
Palm Beach Gardens,
FL 33410-3487, USA. (Requests for offprints to JEU)

Correspondence to: J. E. Upledger;
Tel: +1 561 622 4706; Fax: ++ 1 561 622 4771

Received September 1997
Accepted October 1997

Journal of Bodywork and Movement Therapies (1998) 2(1), 31–33

corresponds to the CRI rhythm. The CRI may not be the final, fundamental harmonic. Sutherland alluded to deeper, more subtle, harder-to-detect rhythms besides CRI (Sutherland 1990). His student, Rollin Becker, described 'the slow tide', oscillating with a frequency of 0.6 cycles/min (Becker 1994). James Jealous describes a third rhythm, which he simply calls the '21/2 CPM rate', with a frequency of 2.5 cycles/min (McPartland & Mein 1997).

We should also investigate the *modus operandi* of practitioners who bring about therapeutic changes in the CRI of their patients – perhaps 'healing' represents entrainment between individuals. Over 300 years ago, Christiaan Huygens noted that pendulum clocks with the same length pendulum began swinging in synchrony with each other (Strogatz & Stewart 1993). This coupling phenomenon is seen in synchronously flashing fireflies, harmoniously chirping crickets and women whose menstrual phases cycle together. Huygens noted that the 'strongest' clocks (those with the heaviest pendulums) establish the eventual, overall rhythm. Perhaps practitioners transfer their 'strong clock' harmonic rhythms onto their patients. Skilled practitioners enhance this transfer by assuming a meditative focus before treating patients. Empathetic, meditative, 'centred' states are known to produce strong entrainment (McCraty et al 1995, Tiller et al 1996). Practitioners can then influence, or 'pull' the patient's dysfunctional state towards a more balanced and harmonic state.

Dr J. E. Upledger

Question 1

I cannot be William Sutherland; however, I can be myself and perhaps project how I feel and react when I see things that are inexplicable by the body of knowledge at the time that such an inexplicable event is observed.

First, I believe that all things designed in Nature are for a reason. Thus, looking at the sutural design of the skull, be it human or otherwise, would indeed invite me to develop an array of ideas relating to why Nature made these designs as she did. I would consider motion as one possibility. This motion could be for more than one purpose. Certainly accommodation of the head to the birth canal is one. Another would be to accommodate the growth of the skull, brain, etc. from a newborn to a full grown adult. Yet another might be as a shock absorber design that limits the spread of fractures from a single site to the whole skull. Still another possibility is certainly that the skull and its sutures are designed as they are in order to accommodate some sort of physiological activity that is unknown at the present time. Our own current investigations suggest a pumping action that might help move red blood cells from the bone marrow into the vascular system.

I would then begin to explore the feasibility of all of these possibilities and at the same time keep my mind open for other possibilities as they might present themselves.

As I carried out my search, I assume then that I would feel with my hands a subtle rhythmical motion. As I trust my hands and the messages they give me, I would accept the idea that there is a physiological activity or system related to this motion that I feel. This would be an activity or system of which we have little or no understanding at this time. I would suspect that the sutural design was made in order to accommodate this motion.

This is probably where I would depart from many of my scientist friends. I believe that we offer a major disservice by prematurely developing an explanation for an observed phenomenon. I would continue to observe and make models that are very much subject to change as the breadth of observed activities continued. It is quite possible that I would change a model on a daily basis. I am quite content to report that something occurs, that it can be relied upon and made use of in any number of ways without my understanding how or why it works.

Fortunately for me, my first exposure to the craniosacral system was during a surgical procedure wherein the dural membrane was exposed and visible, and it was also kept intact. I saw the rise and fall of cerebrospinal fluid pressure and volume within the watertight compartment formed by the dural membrane. I saw the effect of these fluid dynamics first hand. Had I not seen this, I doubt that I would have become involved in the investigation of the skull, the spinal canal, the

John E. Upledger DO OMM
The Upledger Institute, Inc.,
11211 Prosperity Farms Road,
Palm Beach Gardens,
FL 33410-3487, USA. (Requests for offprints to JEU)

Correspondence to: J. E. Upledger;
Tel: +1 561 622 4706; Fax: ++ 1 561 622 4771

Received September 1997
Accepted October 1997

Journal of Bodywork and Movement Therapies (1998) 2(1), 31–33

meningeal membranes, the cerebrospinal fluid and their effects upon bodily functions.

Question 2

I do not accept the statement that the sphenobasilar junction is fused by age 20–25 years. Dr Retzlaff and I examined several fresh human and fresh baboon skulls. These skulls were not embalmed nor had they been subjected to chemical preservatives of any kind. They were cooled only to inhibit deterioration. They were sent to us as part of a research contract that we had with the US Air Force. These fresh cadaveric skulls showed that the sphenobasilar junction remains a cartilage bar well into adulthood in both humans and baboons. It is relatively free of ossification and certainly not 'fused'. If my memory serves me correctly the oldest human skull that we studied was 57 years of age and male. Cartilage, while alive, is quite flexible. Anyone who has participated in surgical procedures involving cartilage is aware of its flexibility. Therefore, I have no doubt that the sphenobasilar juncture is a synchondrosis and is capable of motion throughout life.

Question 3

Yes, there is an objective cranial rhythmic impulse. The rate varies with physiological conditions and it also stops periodically, seemingly of its own volition. My own observation has been that the impulse may stop during emotional crisis, or some physiological adaptational situations, and it can be stopped by the therapist. At Michigan State University during 1975–1983 we measured its activity on live monkeys. We also did inter-operator reliability studies that confirmed its existence.

A biophysicist, Dr Zvi Karni, and I measured total body electrical potential fluctuations during craniosacral therapy treatments during those years. Dr Karni found that significant changes in electrical potential accompanied impulse stops during treatment. In 1978 I was a visiting professor at the Technion Institute in Haifa, Israel. During this time Dr Najenson, the Chief of Neurology at the Loewenstein Institute in Ra'anana, Israel, was able to record baseline fluctuations in EMG tracings that corresponded to my perceptions of the craniosacral system's activity as recorded on synchronized auditory tape. It was also during this time that Joseph Mizrahi PhD (biophysics) and I recorded the craniosacral system activity with strain plethysmography.

All of this aside, our Institute has trained over 27 000 therapists in craniosacral therapy over the past 11 years. Over 50% of these therapists have continued to higher levels of training. This means that at least 13 500 therapists feel and work with the craniosacral system and its rhythms. I am also fairly certain that many of the students who did not continue beyond introductory studies also feel this rhythm. From my perspective, this is more compelling than the technological work we did.

I still find the usual rate of craniosacral rhythm to be between 6 and 12 cycles per minute in reasonably normally functioning humans. It is more rapid in monkeys and smaller animals. I also have had the opportunity to palpate the head of a dolphin in the water. The craniosacral system rate of activity was about 8 cycles per minute.

For the sceptics I would quote the famous pathologist, Rudolph Virchow: 'The absence of proof does not necessarily demonstrate proof of absence'.

Question 4

My clinical experience would indicate that cranial and sacral motion is synchronized under reasonably normal circumstances. Many of our spinal injury patients and post-spinal surgery patients have loss of synchrony or no sacral motion. We see surprisingly good clinical response in pain, paresis, paralysis and sensory loss of the lower body when we are able to mobilize the dural tube and the sacrum, and develop a synchronous motion between the cranium and the sacrum.

I believe that the dural tube and the cerebrospinal fluid are key factors in this cranial sacral synchrony and its clinical effects. In my research experiences, we were consistently able to stop the objectively recorded parietal bone motion of the anaesthetized monkey by the use of very small pressure on the sacral apex and coccyx. I applied this pressure with my fifth finger while the monkey was in a sitting position in the anaesthesia chair. This pressure probably brought both hydraulic and membranous forces into play. Working with two fresh adult human cadavers in the morgue of a major American university, we removed the brain through 1.25-inch-square (32-mm) windows cut in the parietal bones in such a way that we remained away from all parietal sutures and, of course, the sagittal venous sinus. The brain tissue was removed by blunt finger dissection and water irrigation so as to minimally disturb the intracranial membrane system. The bodies were then laid in the supine position on tables. Fixed position cameras were mounted and three black marker dots were placed on each side of the falx cerebri in the form of a triangle. These dots were visible to the cameras through the windows in the parietal bones. A physicist then measured the traction forces required upon the frontal bone, the temporal bones and the sacrum in order to induce recordable movement of the falx cerebri as indicated by the dots. We found that anterior frontal traction of 2–3 ounces (50–75 g) moved the falx cerebri. I applied force manually on the sacrum in a direction that would move the apex anteriorly. We rather crudely measured my force with an air-inflated bladder interposed between my hand and the body. We recorded movement of the falx cerebri at about 6 ounces (175 g) of force on the sacrum. No head movement was measurable on the photographs, only falx cerebri movement. Thus the paravertebral muscles were ruled out as a factor in this experiment. There was no cerebrospinal fluid in a hydraulic system. There was no life energy or active nervous system to create what we recorded. I know of no other factor than the dural membrane attached to the sacrum that could have transmitted my force and induced the movement of the falx cerebri.

More important is the fact that at least a few thousand craniosacral therapy practitioners manually evaluate the synchrony or lack of it in the cranium and the sacrum every week. The clinical results when dural tube restrictions are corrected are excellent. Personally, I believe that this synchrony is a result of several factors: among them are the hydraulic forces, the dural membrane connections, electromagnetic fields, intentions and other energies that as yet may be unnamed.

Question 5

I feel that clinical outcome studies are what are needed. I have done a lot of laboratory and basic research involving the craniosacral system. As we do clinical outcome studies, our observations will lead us to new questions and new models that will beg investigation.

I also believe that some work should be done to document the sensitivity, the validity and the reliability of the human being as an instrument of investigation. Honestly, I have learned to trust the skilled hands more than the instrumentation that is used. When I was a research fellow in biochemistry I recall my mentor, Dr Stacy F. Howell, telling me that 'when physical diagnosis suggests one thing and the laboratory does not support what you have found, suspect laboratory error'. I have often found this to be the case. I should like to see us develop our human gifts and not become further and further dependent upon impersonal instruments and devices to tell us what is going on. If we do not develop, nurture and use our gifts, they may be lost.

Dr M. Collins

Question 1

There are two explanations required: the arrangement of the cranial articulations and the subtle movements within the cranium and throughout the body.

Regarding the former, osseous motion must be an expression of function consistent throughout the species. It is perhaps significant that higher primates display features of neoteny, whereby characteristics of early development persist to a greater degree into later life than is so with their ancestors. The maintenance of sutural mobility may be due to this. Sutural mobility, as a shock absorber to reduce the incidence of cranial fracture, may have selective advantage associated with the precariousness of an arboreal existence, of general importance in the evolution of the anatomy of higher primates. The sutures may be viewed as the persistence of the primitive meninx.

In addition, osseous motion has an individual expression of function/dysfunction that is both temporal and spatial. The number and extent of interdigitations varies between individuals.

The movement of the cranium and throughout the body requires further explanation, particularly since this movement is rhythmic. Living bone is but a connective tissue, with a rich blood supply, but with crystals of hydroxyapatite deposited in it. Living bones, especially the thin bones of the cranium, can therefore respond to mechanical forces, i.e. are 'flexible'. Rhythmic activity is a feature of all living organisms. It is evident even at the cellular level of organization and in acellular organisms. It is a feature that distinguishes what is alive from what is dead. There are many explanations for such rhythms at a cellular level (the widespread occurrence of contractile microfilaments, rhythmic membrane pumps), at a tissue level (contractile fibroblasts), or at a systems level (reviewed by Chaitow 1997). It is significant that it is recorded throughout the body. The movement of the cranial bones can be viewed as concomitant with movement of the tissues as a whole, or as an effect of this, especially palpable to the beginner in craniosacral work because they serve as fulcra, as articulations permit mobility.

M. Collins
The British School of Osteopathy
275 Borough High Street,
London SE1 1JE, UK

Correspondence to: M. Collins;
Tel: +44 171 4070222; Fax: +44 171 8391098

Received October 1997
Accepted November 1997

Journal of Bodywork and Movement Therapies (1998) 2(1), 33–34

Question 2

There are two issues in this question: What are the limitations on palpation of motion? How much motion occurs at the sphenobasilar junction in fresh bone after fusion? (Whether gross mobility is considered to occur in current involuntary motion studies (IMS) theory, or 'it be considered as a reference point around which patterns of mobility are named' is another issue.) Neither of these questions can be answered in the absence of rigorous research. However, with respect to the former, the sphenobasilar junction is far removed from where mobility is palpated (on the surface of the cranium). However, it presumably has no less mobility than other bones and any failure to conform to the general movement of tissues might exert an incongruity palpable even on the surface. The femur undergoes longitudinal bowing and torsional rotation during the gait cycle that reflects functional changes in growth, so with the cranial bones, especially the sphenobasilar, we might expect similar flexibility.

Question 3

This raises the issue of 'objectivity' and how it is defined. There is not the space to argue the weaknesses in the concept of objectivity. A wide range of methodologies exists; the limitations of each must be acknowledged in interpretation of results. I consider that there is 'evidence' for a cranial rhythmic impulse (as part of a rhythmic impulse of the body as a whole) and that it is 'palpable'. It is indeed 'measurable', but the quality of the measuring instruments needs to be ascertained. The motion is a combination of species-specific motion and is individually specific. That a process of mental filtering takes place by the palpator must be acknowledged and this influences the recorded rate. I have found the rate variable (approx. 10–15 times/minute), but my experience of palpating the involuntary mechanism is very limited. The rate may not be as important as understanding the 'filter' mechanisms.

Question 4

In a healthy state one would expect synchrony of all tissues in that all are entrained to a common innate rhythm. I do not consider, therefore, that movement of the cranial base controls the sacrum via the dura, like a string puppet. Furthermore, I do not consider that the dura is inelastic and anatomically capable of transmitting minor forces along it without loss of energy.

Question 5

- (i) The recording of rhythms at a cellular and tissue level and in other species. (A considerable literature already exists to review.)
- (ii) The accurate assessment of cranial bone flexibility and sutural mobility in fresh human cadavers and other mammalian species.
- (iii) The histology of sutures and the nature of proprioceptors within them.
- (iv) Intra-observer and inter-observer reliability of palpatory recording.
- (v) The development of a common language for describing palpatory findings.
- (vi) The determination of the psychological processing/filtering of palpatory information.
- (vii) Measurement of surface rhythmic activity.
- (viii) Exploration of physiological mechanisms proposed for rhythmic impulses.

R. Lever

R. Lever BA DO MRO
1 Oldbury Place (off Nottingham Street), London WIM 3AN, UK

Correspondence to: R. Lever;
Tel: +44 171 486 2875

Received October 1997
Accepted November 1997

Journal of Bodywork and Movement Therapies (1998) 2(1), 34–37

Question 1

Sutherland's ideas have to be seen in relation to the social, scientific and philosophical context of the time. It would seem that as a spiritual man, Sutherland struggled, in part, to divorce his findings and hypotheses from a quasi-cosmological framework and, as behoves all in the applied sciences, to explore explanations for his ideas with a 'known' scientific and increasingly mechanistic flavour. Any notion of applying quantum theory to the understanding of living organisms and their interaction was even more foreign in Sutherland's day than it is now, and yet it seems increasingly apparent that it is only when one allows the interplay of Newtonian and quantum principles to colour our perception of cosmology and the function of living organisms that we can come closer to understanding the micro-motion that plays so vital a part in 'cranial osteopathy'.

If we then impute a theory based on patterned information or intelligence (centred on DNA) to explain tissue renewal and tissue motility in health, and if we also impute changes or perversions of these patterns in disorder or disease, we might get closer to interpreting changes that will soon be measurable in terms of electromagnetic patterning. In Sutherland's time, any reference to electromagnetism would have been seen as regressive, recalling the early days of Still and Mesmerism. One feels, however, that Sutherland continued to respect this approach to natural phenomena. But perhaps many then (and certainly in recent decades) in the profession would still consider such ideas regressive. In the early days of Sutherland's ideas, the trend towards increasingly mechanical explanations of natural phenomena would have been hostile to such thinking. However, the 'electronic' era of the end of the 20th century is interestingly more sympathetic to the notion of phenomena that have invisible and often intangible modes of function. Today, Sutherland would, I hope, be able and inclined to blend his knowledge of anatomy with a 'vitalism' expressed in rhythmicity and his 'respiratory' concept and a theory of micro-motion based on fields of patterned intelligence expressed in and by all living tissues. Thus we might break away from an obsession with causes that reflect linear processes about CSF 'driving' membrane 'driving' bone.

The expression of movement could then be seen as: a species-specific modulation of rhythmicity expressed throughout the natural world, modified and distorted by individual genetic and personal/clinical profiles, and expressed and shaped qualitatively and directionally through tissue/structural morphology (hence structures have their own characteristic patterns of motion in both normal and abnormal circumstances). The nature of movement is further specific to tissues and structures of all types: muscle, membrane, fluid, viscera, etc.

Sutherland's attempt to yoke together the known with the subtle was nothing short of remarkable and it is likely that the subtle will be much more satisfyingly explained in coming decades even if this involves a departure from the old scientific paradigm at times.

It does seem likely that when Sutherland described movement in cranial structures, he was perfectly aware that he was describing some sort of subtle and vital micro-motion, an expression of patterned potential or information, and not the sort of motion that it is all too easy to refute based on what we know (and knew) of anatomy. I think we are living in a time that will prove to be more sympathetic to a real substantiation of Sutherland's inspiration.

Question 2

As I suggest in the answer to question 1, the quality of motion in structure is probably an expression of intelligence and pattern. It is present in all living tissues reflecting a resilience, compliance and vitality. The quality of movement will vary depending on the nature of the tissue, its position and morphology and its state of health both intrinsically and contextually.

Thus, in bone, the quality of motion tends to differ, for example, whether we are looking at intraosseous or interosseous motion, i.e. the movement within a bone or the movement between bones at sutures. States of fusion related to maturation will modify but not obliterate movement, which continues in structures whether fusion has occurred physiologically or pathologically.

Question 3

If we look at physics today, it would seem that we inhabit a 'participatory' universe in which everything is in a state of dynamic interchange and exchange. Even the act of observing changes that which we observe so that our universe cannot be completely objectively assessed.

It is probable that as we observe the patient and engage the phenomena that the patient's body reveals to us, it alters. This almost certainly includes the quality, direction and rate of the cranial rhythmic impulse as it manifests in structure. As one 'highly charged' organism interacts with another (patient–practitioner), it is highly likely that we experience 'evidence' of spontaneous interaction. Our technique provides us with a strategy that enables us to interpret and direct change towards patterns of balance and integrity for patient benefit (perhaps practitioner benefit too!). The CRI rates are variable, of course, but unless extreme (outside a range of about 6–14/minute), probably of little clinical significance. Quality is probably much more significant than quantity. Whereas practitioners have identified other slower or longer cycles, which are variously interpreted, it is likely that most practitioners working in the cranial field are focused primarily on 6–14 cpm.

Question 4

Ideally, the body manifests integrated balanced motion throughout in which the patterns of flexion and extension (external and internal rotation), are coordinated. This synchrony is itself a manifestation of health and harmony through the body.

However, the body is constantly adapting and adjusting to a variety of intrinsic and extrinsic demands, so that synchrony and balance can be compromised. Indeed, the efficiency with which these adaptive changes are made could be seen as one of the criteria of good health. In ill health, the loss of synchrony can be severe, complex and persistent, requiring treatment to restore a pattern that corresponds to a norm. At any given moment in a healthy individual, adaptive processes might threaten synchronous motion between cranium and sacrum. This might correct spontaneously or easily with minimal therapeutic assistance. My belief is that integrated movement is, by definition, synchronous and contemporaneous and not 'driven' from one place to another, as is the case to some extent with the body's transport mechanisms of circulation, for example. Once again, in the cranial field, the mechanical conceptual model is inadequate.

Question 5

Research/experimentation required:

(i) Research into electromagnetic fields and patterns of manifestation in living organisms.
(ii) Examination of cyclical activity or rhythmicity in living organisms.
(iii) Exploration of the implications for physiology of quantum theory.

Conclusion

It is refreshing that such intelligent and open-minded answers have been given to the simple, if perplexing, questions asked. Osteopathy has always been strong on practice but, until recently, weak on theory and research. The answers here show that we are beginning to understand the complexity of human function and interaction.

In question 1 the answers vary in their focus from the broad cosmology of Lever to the specific physiology of Collins, via the experience and experiments of Upledger and the new 'entrainment' model of McPartland. I am sure that Sutherland would have been happy with all of them.

Question 2 addresses a particular area of controversy. McPartland ascribes apparent motion at the sphenobasilar junction in adults to intra-osseous bone flexibility throughout the cranial base. This is also similar to the views of Collins and Lever. Upledger suggests that the junction does not fuse and remains a mobile synchondrosis throughout life.

Question 3 produces differing views. McPartland suggests that the cranial rhythmic impulse (CRI) is produced by an interaction between many rhythmic processes of the patient and practitioner and therefore is subjective not purely objective, although it can be measured at about 7.5 cycles per minute (cpm). Collins feels a rhythm of 10–15 cpm although he is concerned that the palpator's perception could influence the rate. Upledger is confident that there is an objective CRI usually in the range of 6–12 cpm, and has made experimental measurements in confirmation. Lever emphasizes the practitioner's participation in the measurement, which he feels at around 6–14 cpm, but suggests that quality is probably more significant than the rate.

Question 4 concerning sacral motion is answered by McPartland and Lever, who consider that the CRI is integrated, and palpable, throughout the body and produced by the whole body, not just the cranium driving the sacrum and the rest. Collins does not consider that the cranial base and sacrum could be synchronized by an elastic dura that would absorb minor forces. Upledger considers that cranium and sacrum are normally synchronized by the dura and has experimentally observed movement in the falx cerebri caused by moving the sacrum in cadavers.

Question 5 confirms the need for further research in many areas.

In my opinion these answers, and a recent overview of aspects of craniosacral theory by Leon Chaitow (1997) confirm a willingness to question the old dogma and move forwards into areas of uncertainty but great interest and potential for the future. Moving away from mechanical models to more holistic and inter-subjective interpretations opens up the inclusion of many other important areas of human function and health, particularly emotional and social influences that are crucial to our understanding and practice. Emotions and psychological qualities such as character are profoundly influential physical phenomena (Latey 1996). Since my student days, 20 years ago, I have always experienced a rhythm of around 1 cycle per minute as the strongest, with all the faster ones feeling somewhat superficial! Certainly the appreciation of the CRI is as much, or more, influenced by the practitioner as by the patient. Perhaps this understanding will help us to treat people rather than 'mechanisms', and to keep asking questions.

REFERENCES

Barman SM, Gebber GL 1976 Basis for synchronisation of sympathetic and phrenic nerve discharges. Am J Physiol 231: 1601–1607

Becker RE 1994 The cerebrospinal fluid as a mechanism. Cranial Letter 47: 7

Chaitow L 1997 Review of aspects of Cranio-sacral theory. British Osteopathic Journal XX: 14–22

Diehl RR, Biehl B. Sitzer M, Hennerici M 1991 Spontaneous oscillations in cerebral blood flow velocity in normal humans and in patients with carotid artery disease. Neurosci Lett 127: 5–8

Feinberg DH, Mark AS 1987 Human brain motion and cerebrospinal fluid circulation demonstrated with MRI imaging. Radiology 163: 793–799

Ferguson A 1991 Cranial osteopathy: a new perspective. Journal of the American Osteapathy Association 1: 12–16

Frymann VM: A study of the rhythmic motions of the living cranium. Journal of the America Osteapathy Association 70: 928–945

Green E 1983 Foreword. In: Upledger JE, Vredevoogd JD (eds) Craniosacral therapy. Eastland Press, Chicago, p. xi–xiv

Jenkins CO, Campbell JK, White DN 1971 Modulation resembling Traube-Hering waves recorded in the human brain. Eur Neurol 5: 1–6

Kappler RE 1979 Osteopathy in the cranial field. Osteopathic Physician 46: 13–18

Latey P 1996 Feelings, muscles and movement. Journal of Bodywork and Movement Therapies 1: 44–52

Llinas R 1993 Is dyslexia a dyschronia? Annals of the New York of Academy of Sciences 682: 48–56

Lumsden CE, Pomerat CM 1951 Normal oligodendrocytes in tissue culture. Exp Cell Res 2: 103–114

McCraty R, Atkinson M, Tiller WA 1995 New electrophysiological correlates associated with intentional heart focus. Subtle Energies 4: 251–268

McPartland J Mein J 1997 Entrainment and the cranial rhythmic impulse. Alternative Therapies in Health and Medicine 3: 40–45

Magoun HI 1976 Osteopathy in the cranial field, 3rd edn. Journal Printing, Kirksville, MO.

Mitchell FL Ir 1987 Clinical significance of cranial suture mobility. In: Retzlaff EW, Mitchell FL Jr (eds) The cranium and its sutures. Springer-Verlag, Berlin

Norton JM 1991 A tissue pressure model for palpatory perception of the cranial rhythmic impulse. Journal of the American Osteopathy Association 91: 975–994

Olszewski WL, Engeset A 1979 Intrinsic contractility of leg lymphatics in man. Preliminary communication. Lymphology 12: 81–84

Strogatz SH, Stewart I 1993 Coupled oscillators and biological synchronization. Scientific American 269: 102–109

Sutherland WG 1939 The cranial bowl. Free Press Co, Mankato, MN,

Sutherland WG 1990 In: Wales A (ed) Teachings in the science of osteopathy. Rudra Press, Portland, OR

Tiller WA, McCraty R, Atkinson M 1996 Cardiac coherence: a new, non-invasive measure of autonomic nervous system order. Alternative Therapies 2: 52–65

Upledger JE, Vredevoogd JD 1983 Craniosacral therapy. Eastland Press, Chicago

Urayama K 1994 Origin of lumbar cerebrospinal fluid pulse wave. Spine 19: 441–445

Vern BA, Schuette WH, Leheta B, Juel VC, Radulovacki M 1988 Low-frequency oscillations of cortical oxidative metabolism in waking and sleep. Journal of Cerebral Blood Flow Metabolism 8: 215–226

Ward RC 1997 Integrated neuromusculoskeletal release and myofascial release. In: Ward RC (ed) Foundations for osteopathic medicine. Williams & Wilkins, Baltimore, p. 843–849