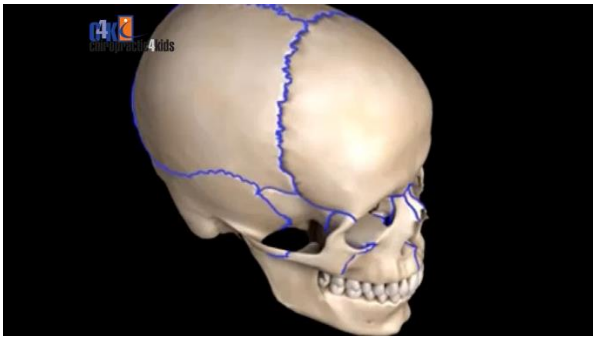
Cranial bones and CSF movement.

In my experience, one of the most important, and yet least understood concepts when it comes to the art and practice of craniosacral therapy within the chiropractic profession, is the direction and extent to which the cranial bones actually move. There are many texts, DVD's, as well as articles available which discuss the movement of the cranial bones and the sacrum. Unfortunately, in my experience, the average practitioner will often find themselves more confused after sifting through this information, than he or she was before. When presenting this material therefore, the greatest challenge lies in the ability of the presenter to take a complicated system and to simplify it, so that it becomes both understandable and practical for the private practitioner; while still maintaining the essential facts and important principles of craniosacral movement.

Bones of the Human Skull



An essential starting point is to have a sound knowledge of the anatomy of the human skull.

The human skull is made up of eight cranial bones that surround and protect the brain and 14 facial bones that form the underlying structure of the face and support for the teeth. With the exception of the mandible the bones of the skull articulate with each other through joints known as sutures. Throughout the skull there are the numerous foramina which serve as passageways for blood vessels and nerves. The bones on the surface of the skull encase the brain, protect sensory organs and serve as attachment sites for the muscles of the head and neck.

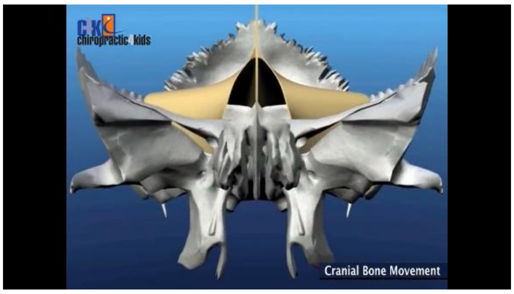
These bones include the occipital bone, parietal bones, temporal bones and the frontal bone. As well as the nasal bones, the zygomatic bones, the maxilla, and the mandible. Other bones become more visible only when looking inside the skull.

The sphenoid bone makes up the anterior base of the cranium. It is a butterfly shaped bone with a central body and 2 pairs of laterally projecting wings. These wings form portions of the orbit. The body of the sphenoid bone features a depression known as the seller turcica which houses the pituitary gland.

The 2 L shaped Palatine bones form the posterior third of the hard palate, part of the nasal cavity, and a portion of the orbit.

The vomer is an elongated bone that forms the inferior and posterior part of the nasal septum.

The Physiology of Cranial Bone Movement



It has been well established that there exists in the skull a physiological pattern to cranial bone movement. It is a simple fact that no cranial bone moves independently. Movement originating in any part of the cranium will create changes in motion of the entire cranium. My intention here is not to try to present a comprehensive discussion on the movement of all eight cranial bones and 14 facial bones. My aim here is to attempt to provide a concise and clear explanation of the movement of those cranial bones which are most relevant to the private practitioner in his management of children. It makes sense that only when you have a good understanding of the normal movement of the cranial bones, can you hope to detect abnormal movement, and then subsequently restore correct function to the craniosacral system.

There are two major types of cranial motion that need to be taken into account when evaluating the cranium of the paediatric patient. The *primary respiratory motion* is the motion in the cranial bones and dural system which is created by the movement of CSF as it travels throughout the spinal and cranial meninges. The *secondary respiratory motion* is the motion in the cranial bones and dural system that is created by forced or prolonged diaphragmatic respiration (inhalation and exhalation).

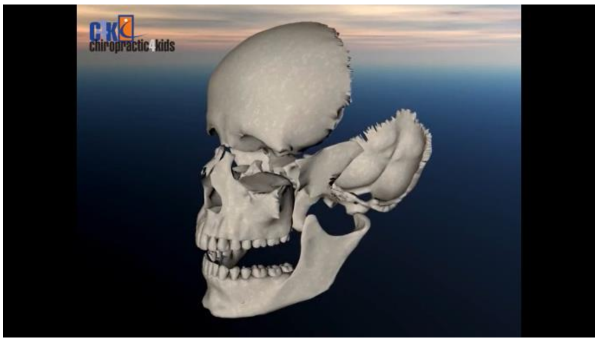
Under normal circumstances, the production and reabsorption of cerebrospinal fluid within the dura mata produces a continuous rise and fall of fluid pressure within the craniosacral system. The system expands and contracts with this rhythmical pressure fluctuation. The normal rate of this primary respiratory craniosacral rhythm in humans is between 6 and 12 cycles per minute. Under normal circumstances this rhythmic activity appears at the sacrum as a gentle rocking motion about a transverse axis located approximately one inch anterior to the second sacral segment. The rocking motion of the sacrum correlates rhythmically to a broadening and narrowing of the transverse dimension of the head. As the head 'widens', the sacral apex moves in an anterior direction. This phase of motion is referred to as flexion of the craniosacral system. During the extension phase, the head 'narrows and elongates', the sacral base moves anteriorly while the sacral apex moves posteriorly.

As we have discussed, in addition to this primary respiratory motion, there is an additional movement which may occur during breathing. During prolonged inhalation the cranium, spine, and dura move into flexion and external rotation. As with the primary respiratory rhythm, this creates a state in which the cranium opens up at the sutures, which expanded the cranium laterally and decreases the anterior-posterior relationship between the superior portion of the frontal bone and the occipital squama. During prolonged exhalation the cranial bones go into a state of internal rotation and extension (directly opposite the inhalation phase). It is a combination of these mechanisms, both primary and secondary respiratory motion, which influence the rather complex and intricate movements of the dura, the cranial bone movement, and the CSF flow.

Age Considerations with Cranial Assessment

When assessing the craniosacral system of the paediatric patient, the age of the child will influence not only your examination procedures, but also the specific cranial techniques you chose to implement with that child. When examining a newborn baby, their shallow and rapid respiration rate will preclude you from assessing for secondary respiratory motion, and thus you need to develop your skills in assessing CSF flow and cranial movement as a result of the primary respiratory motion. In the older child however, inhalation and exhalation may be used to aid in the assessment and subsequent treatment of cranial dysfunction.

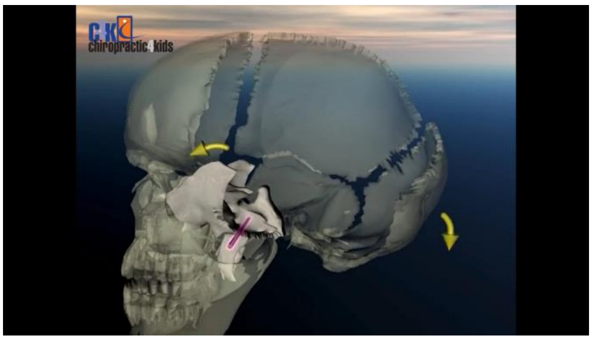
Cranial Bones Movement



The cranial bones we will discuss here in relation to their movement include the frontal, parietal, occipital, sphenoid, temporal, the maxilla, (and its relationship with the palatine bones and the vomer). As you progress through this module I encourage you to have a skull on hand. This will help you to get a three-dimensional understanding of the complex anatomical relationships each cranial bone has with the rest of the skull. You may even wish to draw arrows on the skull, to use as visual cues which will help you in your learning.

In the paediatric patient, regardless of the child's age, the region where flexion and extension is most significant is at the sphenobasilar junction. During inhalation or flexion the angle of the sphenobasilar is reduced, whereas during extension it is increased. Let us therefore firstly look at the movement of the sphenoid, and its relationship to the basilar part of the occiput.

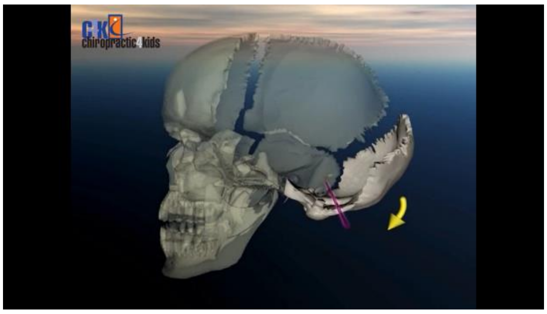
Sphenoid



The terms 'flexion' and 'extension', when applied to the cranial mechanism, essentially refer to the superior and inferior physiological movement occurring at the sphenobasilar junction. The cranial movement accompanying flexion at the sphenobasilar junction will decrease the downward angle of this joint, and as we have discussed will result in variations in the general shape and dimensions of the skull. In extension the downward angle at the sphenobasilar junction will increase and the changes in shape and dimension are reversed.

The greater wings move anteriorly, slightly laterally and inferiorly. This then influences the lateral aspects of the frontal bone.

Occiput



During flexion, the occiput rotates about a transverse axis with the centre of rotation just superior to the foramen magnum. This rotation results in the basilar part (that which articulates with the sphenoid), at the occipital condyles moving anteriorly and superiorly, which directly influences the temporal bones.

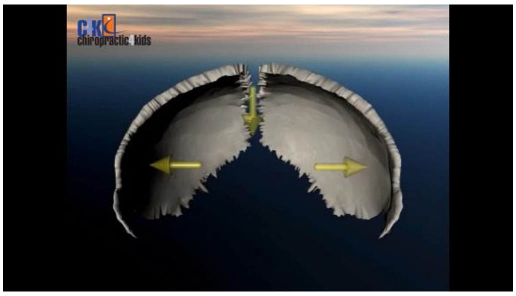
The squamous part of the occipital bone moves posteriorly and slightly laterally.

Temporal (temporal vid + zygoma vid)

During flexion, the superior borders of the temporal squama move anteriorly and laterally. This results in a broadening of the transverse diameter between the two temporal squama.

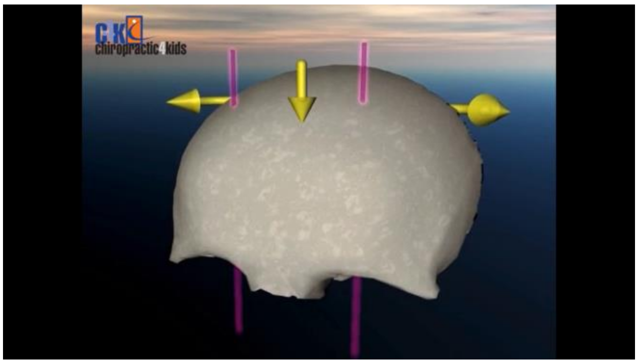
As a result of this movement the zygomatic processes move inferiorly and the mastoid moves superiorly and posteriorly.

Parietal



The nature of the suture between the temporal squama and the parietals allows for a gliding motion between these two bones. This means that when the temporal superior margins move anteriorly, the parietals also move forward as they spread laterally. The sagittal suture between the two parietal bones widens during flexion. The inferior aspect of the parietal bone moves laterally.

Frontal



During flexion, under the influence from the sphenoid via the spheno-frontal suture, the inferior portion of the frontal bone moves anteriorly and laterally.

The Maxillae, Palatines and Vomer

The maxillae, the palatines and the vomer may be considered as a single functioning unit which is anchored to the sphenoid bone. The vomer provides continuity between the superior surface of the hard palate at the midline and the sphenoid. This is how, as a practitioner, you can directly influence the function of the spheno-basilar junction through contact with the hard palate. In doing so you are also thereby potentially indirectly influencing the function of the other cranial bones, including the occiput, temporal and parietal bones.

When contacting the hard palate, it is important to be also aware that the maxillary bones externally rotate as the cranial base flexes.

Knowledge of the movement of the individual cranial bones during flexion and extension, as well as the rhythmic movement of the entire cranium with the sacrum, is the first step to understanding and then palpating the craniosacral rhythm in the paediatric patient.

I encourage you to go through this video a number of times, perhaps with your model of the skull handy, in order to develop your awareness and understanding of this complex system. Only then should you move on to the next video which discusses the cranial assessment and adjustment of the neonate and baby.