Practical Applications of Utilizing Embryology in Osteopathy

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AAO Convocation
Saturday, March 25, 2017
1230 and 1500
Disclosure

- I have nothing to disclose!
- I am a proud member of the AOA, AAO, OCA and the ACOFP!
Objectives

- Visualize the embryology through a quick review of lecture material
  - Pharyngeal arches
  - Lower extremity
- Understand how the unfolding of the embryologic structures evolve into anatomic structures
- Visualize the fascial lines and connections
- Identify the acupuncture points located at key junctures of the fascial lines
- Utilize the acupuncture points as access points to balance the fascial lines while visualizing the embryologic structures. This therefore balances the area as a whole.
“The job of the healer is to help the soul find its way home”—Cherokee philosophy
"An Osteopath reasons from his knowledge of anatomy. He compares the work of the abnormal body with the work of the normal body."
- Osteopathy Research and Practice

"You begin with anatomy, and you end with anatomy, a knowledge of anatomy is all you want or need . . .”
- Philosophy of Osteopathy
The Pharyngeal Arches

Sagittal Views

- Pharyngeal arches appear (day 26)
- Maxillary prominence of 1st pharyngeal arch
- Mandibular portion of 1st pharyngeal arch
- 1st pharyngeal arch
- 2nd pharyngeal arch
- 3rd pharyngeal arch
- 4th pharyngeal arch
- Forebrain prominence
- Limb buds appear (days 28-29)
- Arm bud
- Leg bud

Week 4 (middle) 4.0 mm
Week 4 (late) 5.0 mm

Otic pit
Lens placode
Heart bulge
Umbilical cord
Tail bud

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Frontal view of an approximately 30-day embryo showing the positions of the stomodeum relative to the medial and lateral nasal prominence and the maxillary and mandibular prominences.
The Pharyngeal Arches

- The pharyngeal arches begin development during the 4th week as neural crest cells.

- **Arch 1 mesodermally** becomes CN V, the muscles of mastication, the anterior belly of digastric, tensor veli palatini and tensor tympani (the muscles CN V innervates).

- **Arch 1 via neural crest cells** ultimately becomes, after cartilaginous blueprints are laid down, *incus, malleus, mandible, maxilla, palatine, squamous temporal bone, vomer, zygoma and the sphenomandibular ligament*.

- **Arch 1 also contributes to the anterior 2/3 (oral) portion of the tongue** (general sensation from CN V).
  - The remainder of the tongue develops from **Arches 2-4**.
Facial Development via Arch 1

- Arch 1 develops into the **frontonasal prominence**, the **maxillary prominence** and **mandibular prominence**
  - These in turn become the maxilla, zygoma, squamous portion of the temporal, mandible, malleus, incus and the muscles of mastication
- **Arch 1 syndromes** include Treacher Collins syndrome and Pierre Robin Sequence
- This presentation will concentrate on Arch 1
The Pharyngeal Arches

- **Arch 2 mesodermally** becomes CN VII and what it innervates, namely the muscles of facial expression, stylohyoid, stapedius, and the posterior belly of digastric.

- **Arch 2 via neural crest cells** becomes stapes, the styloid process, stylohyoid ligament and portions of the hyoid bone (upper body and lesser horn).

- **Arch 3 mesodermally** becomes CN IX, common and internal carotid arteries and stylopharyngeus (innervated by CN IX).

- **Arch 3 via neural crest cells** become portions of the hyoid bone (greater horn and lower body)
The Pharyngeal Arches

- Arch 4 mesodermally becomes part of CN X (superior laryngeal nerve) and what it innervates, namely the muscles of the soft palate (except stylopharyngeus), laryngeal cartilages, cricothyroid, cricopharyngeus, right subclavian artery, aortic arch.
- Arch 4 via neural crest cells becomes nothing.
- Arch 5 involutes.
- Arch 6 mesodermally becomes part of CN X (recurrent laryngeal nerve) and what it innervates, namely the intrinsic muscles of the larynx (except cricothyroid), superior esophageal muscles, laryngeal cartilages, the ductus arteriosus and the pulmonary arteries.
- Arch 6 via neural crest cells becomes nothing.
Blechschmidt

- States the outside forces help to drive embryologic development
- Muscles always arise where there is tensile stress and space to develop
- Dilation results from biomechanical traction
- In dilation fields, tissues lay down and extend into bundles and sheets. This becomes muscle.
- The muscles are dragged by the embryonic cartilage, lengthening the muscles (allowing them to shorten later for movement).
Combining the two

- Taking the knowledge of pharyngeal arches and Blechschmidt’s biodynamic explanation, we can now visualize what occurs.

- As the myotomes (muscles in the dilation fields) migrate, the vasculature, and nerves, and surrounding connective tissues, are taken with them to their final destination.

- Dynamically the muscles become innervated because there is a “spatial opportunity” and a “dynamic occasion” for the nerve.
  - It is theorized by Blechschmidt that the dendrites “suck” themselves towards the tissues to be innervated and are more greatly attracted to areas with thicker epithelium (lips, hands, feet, and genitals).
  - As the somite grows, a dilation field originates adjacent to the neural tube—this becomes the muscle and creates a suction field to draw in the nerve endings.
  - These nerves then become motor nerves.
Prior to treatment think of this from AT Still

The mechanical osteopath who is well versed in the anatomy of this region, its blood supply, its drainage and the functioning processes of the nervous system sees nothing whatever in this definition that is satisfactory or beneficial regarding the cause which has produced this condition.

—Osteopathy Research and Practice
Embryology

- The limb buds first appear during the 4\textsuperscript{th} week as a mass of mesenchyme covered by ectoderm.
- The upper buds are visible by day 26-27.
- The lower limb buds are visible by day 28-29.
- The upper buds develop along the inferior cervical segments.
- The lower limb buds develop along the inferior lumbar and superior sacral segments.
- Each bud forms an apical ectodermal ridge.
  - This helps to dictate growth and development of the limb.
Segmental distribution of dermatomes/myotomes in embryo of 6 weeks

- Occipital (postotic) myotomes
- Cervical dermatomes/myotomes
- Thoracic dermatomes/myotomes
- Coccygeal dermatomes/myotomes
- Lumbar dermatomes/myotomes
- Sacral dermatomes/myotomes
Limb Innervation: Motor

Somatic development

Dorsal root
Ventral root
Epaxial muscles
Dorsal ramus
Ventral ramus
Posterior division
Anterior division
Hypaxial muscles (extensors of limb)

Hypaxial muscles (flexors of limb)
Hypaxial muscles (flexors of arm and shoulder)
Embryology

The limb rotates as it elongates yielding the dermatomes.
Limb Innervation: Sensory

Sensory innervation is distributed radially
Blechschmidt’s limb placode

- This thickened ectoderm becomes densely innervated as is called the limb placode
- The limbs develop because the spinal cord is rapidly elongating
- The limbs form about 4 angles
- The inner tissues of the angles contain veins that are rooted about the peritoneum
  - The peritoneum remains short
  - These veins are rooted and strong
  - They provide a restricting action
  - The ectoderm thickens
Blechschmidt’s limb placode

- The ectoderm drives limb development
- As the limb develops, the vessels are penetrating into the limb but are still tethered by the central vasculature
  - Causes flexion of the limbs
  - This aids in later segmentation into the arm, forearm and hand or thigh, leg and foot
  - The bends exaggerate later in development
  - The skin on the flexor surfaces stays thick
    - Recall from the facial section that nerves are greatly drawn to areas of thickened epithelium
Blechschmidt’s lower limb

- A large blood vessel (femoral artery) restrains growth
- This causes inward rotation of the femur
- This creates the dilation fields for the muscle groups
  - These groups form along lines of tensile stress
  - Tendons form along the areas of transverse compression
  - If there is great compression, a sesamoid bone forms
- The flexion bending, caused by femoral artery restraint and increased growth, creates the knee joint and its associated muscle groups
Combining the two together

- Combining Blechschmidt’s work with dermatomal unwinding paints an interesting picture
- The posterior fascial line and the acupuncture points that overlie it lessen the confusion
- As we will see, this model will allow us to treat, balance and reintegrate the limb with the whole
  - Mechanically, dynamically and energetically
The Posterior Fascial Line (superficial back line)

Extends from the plantar fascia up to the epicranial fascia
The bladder channel acupuncture points about the posterior fascial line
Key bladder points
Key kidney points
Changes in position of limbs before birth:

- **At 5 weeks**: Upper and lower limbs have formed as flimsy appendages pointing laterally and caudally.
- **At 6 weeks**: Limbs bend anteriorly, so elbows and knees point laterally, palms and soles face trunk.
- **At 7 weeks**: Upper and lower limbs have undergone significant rotation about their long axes, facing separate directions, so elbows point caudally and knees cranially.
- **At 8 weeks**: Torso of lower limbs results in twisted or "barber pole" arrangement of their cutaneous innervation.
Nerves of the Anterior and Posterior Leg

The Femoral Nerve (L2-4) and its branches are accessible through Kidney 10 and GB 34 and this helps to reintegrate the anterior portion of the leg.

The Sciatic Nerve (L4-S3 and its branches are accessed through Kidney 1 and Bladder 40 and Bladder 25 and can be utilized to integrate the posterior portion of the leg.

As the nerves are accessed, we are accessing what they innervate and the fascia surrounding those areas, this allows for reintegration of the entire leg.
Today’s lab

- Quick screen of your partner
- Release the shock
- Treat the lower extremities
- Treat the head
Robert Fulford, DO used to speak of the abdominal brain and how it lives in the solar plexus.

This technique helps to release the physical restrictions of negative emotions and is especially useful when treating trauma of any sort.

You must treat fronts to treat backs.

Curiously, in acupuncture, the penetrating vessel points are about this area starting at Kidney 11 (pubic bone) and ascend in parallel lines just lateral to the umbilicus and terminates about the lips and eyes in the face.

Disorders in this vessel can show up as gynecological problems, atrophy of the leg and SOB.
Fulford’s Shock Release

_patient_

- supine

_physician_

- If the patient is female, stand on the left; if male on the right

_technique_

- Place finger pads along the linea alba
  - Approximate your fingers so they are the same length
- Apply gentle pressure towards the spine
  - Take up the slack as the patient exhales
    - This should not be painful
- Palpate release
  - Fascially, cranially or dynamically (increased fluid flow, longitudinal flow...)
- Reassess
  - Somato-emotional release commonly occurs with dynamic release of this area
Treatment of the Lower Extremity

- This point is sometimes considered the master pain control point of the lower extremity. It is and can be exquisitely tender.

- Patient: Supine

- Physician: seated on right side of patient facing the patient

- Technique:
  - Locate the GB 34 point just anterior and inferior to the fibular head
  - Feel for the pull
  - If it pulls towards the foot, your left hand (finger or thumb) will be on the point with right hand cupping calcaneus (monitoring for release)
  - If it pulls toward the femur, your right hand will be on the point (finger or thumb) and your left hand will have your thumb on the origin of the vastus intermedius with your fingers on the IT Band (monitoring for release)
  - Apply gentle pressure to GB 34
  - Monitor the system
  - Palpate until a release is felt
  - Reassess
Reintegration through balance for the lower extremity

Patient: Supine
Physician: seated on affected side of patient facing the patient

Technique:

Place one finger on kidney 1

Place a finger on the other hand on Bladder 25
Reintegration through balance for the lower extremity

- Technique continued:
  - With your fingers on these locations
  - Think about how the limb bud unwinds and the fascia and muscles evolve.
  - Think about how the nerves are sucked into their locations
  - Feel for this unwinding
    - Fascially, dynamically (fluid) or energetically
    - When balance begins, a Still point will be felt
      - Wait here until you feel longitudinal flow
        - Fascially, dynamically (fluid) or energetically
        - The foot will occasionally externally rotate or pronate when the limb is re-integrated
  - Reassess
  - Do on the opposite leg if needed
The trigeminal nerve provides nerve supply to the muscles of mastication and sensory supply to the mouth, face, scalp and portions of the ear.

- The sensory nucleus of the trigeminal nerve can extend into (or distal in some cases) C2
- The facial, mandibular and maxillary arteries provide vascular supply to the area
- The fascia of the muscles of mastication are continuous with the investing fascia of the neck (1st layer of deep cervical fascia) and that attaches to all cervical spinous processes.
Access the area

- Listen to the body
- Let it tell you where to treat
- Visualize the embryology
- Embrace the nerves and vessels
- Gently access the area
  - Consider CN V and how the acupuncture points overlay the anatomy
  - The acupuncture points to the upper right are on the GB channel
  - These points provide reminders of access to the area and overlay the structures detailed above
    - (C1-2 through CN V branch 1)
  - The posterior fascial line terminates in this area as well (lower right)
Treatment of the area

- Restoring balance to the embryologic area is key
- The ability to utilize the acupuncture points and the fascial line will make the process easier and may help you decide what technique to utilize
- Obtain balance for your patient
  - This includes treatment of the whole person
    - Think about conditions that affect the superior, posterior neck, the jaws, the eyes
    - Addressing the mind and spirit will help to attain optimal balance through the superior neck and jaws as well
- Utilizing the concept of ligamentous articular strain
  - Disengage, exaggerate, balance
  - We can treat this area directly or indirectly
    - I usually treat indirect
Initial access is via Acupuncture Points

- Patient: Supine
- Physician: seated at the head of the table
- Technique:
  - Locate GB-12 and GB-20
    - GB-12 is posterior and inferior to the mastoid
    - GB-20 is at the base of the skull, is usually tender and is in the depression between the SCM and trap
  - Apply gentle pressure to these areas until a release is felt
  - Reassess
- GB 12 helps to alleviate pain, regulate harmony between the head and neck and to calm the spirit
- GB 20 is a key point to treat any conditions of the head, including sensory organs, esp. the eyes.
  - Key point in rebalancing the oculocephalogyric reflex
Moving forward

- Patient: Supine
- Physician: seated at the head of the table
- Technique:
  - Locate GB 1, GB 2 and GB 14
    - GB-1 is in the depression just lateral to the lateral canthus of the eye
    - GB-2 is in the divot between the intertragic notch and the mandibular condyle (access with mouth open and then have them close)
    - GB 14 is one fingerbreadth above the supraorbital foramen (middle of the eyebrow)
  - Apply a balancing force to these points until a release is felt
  - Reassess

- GB 1 helps to regulate disorders of the eye
- GB 2 is a key point to treating disorders of the ear, eye and jaw, including mastication
- GB 14 helps with disorders of the eye, headaches (including the face), deviation of the mouth and eye and can help with people who are always cold.
Mandibular rebalancing

- Patient: Supine
- Physician: seated at the head of the table
- Technique:
  - Hand placement:
    - Thumb on the body of the mandibular approximating the mental foramen
    - 1st fingers on C2
    - 2nd fingers on C1
    - 3rd and 4th fingers on occiput
  - Recall the embryology of the 1st pharyngeal arch
  - Recall the path of the trigeminal nerve
  - Think about these while balancing these areas
  - Apply a balancing force to these points until a release is felt
  - Reassess
Questions and comments

- Please make sure you are feeling ok before you leave the lab!!
- I am honored and humbled that you attended my lab!!
- Thank you to all of my table trainers!!
- Thanks for participating!!!
References

- Conversations with Walter Buck, PhD. Professor and Chair of Structural Medicine (Anatomy). RVUCOM.
- Fulford, R. Are We On The Path?: Indianapolis, IN: The Cranial Academy (2003).