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Autonomic Imbalance and the Skull Base

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The process of autonomic dysfunction often begins prenatally

- parental health status
- maternal stress responses
- maternal microbiome
- structural health

All of these issues can contribute to the beginning of autonomic dysregulation

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Maternal Ante-natal Health

- An increase in firing of the maternal sympathetic nervous system and increased stress hormones may have significant effects on intelligence and behaviour **Melillo and Leisman Neurobehavioural Disorders of Childhood. 2004 Springer, New York**
- Oxidative stress, nutritional deficiencies, environmental toxins, drugs and alcohol also can have a direct effect on the foetus and the development of its nervous system
- Higher maternal adverse childhood experiences-ACE scores significantly predicted shorter placental telomere length and greater respiratory sinus arrythmia-RSA suppression in infants **Jones et al Psychoneuroendocrinology. 2019 Aug;106:20-27.**

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Maternal Physiological Stress

- *"Prenatal maternal stress affects the coupling between maternal and fetal heart rate detectable non-invasively a month prior to birth"* **Lobmaier et al Arch Gynecol Obstet. 2020 Feb;301(2):405-414**
- *"Antenatal **maternal psychological distress is common** .....and was found to be associated with key psychosocial measures during pregnancy, as well as **with adverse birth outcomes**"* **McGinty RP et al Compr Psychiatry. 2020 Jan;96:152128**
- *"Results implicate **maternal prenatal stress** as a source of epigenetic mechanisms that affect fetal brain development and **program risk for emotional dysregulation** and mental disorders over a lifetime and across generations"* **DeSocio JE Arch Psychiatr Nurs 2018 Dec 32;(6: 901-906**

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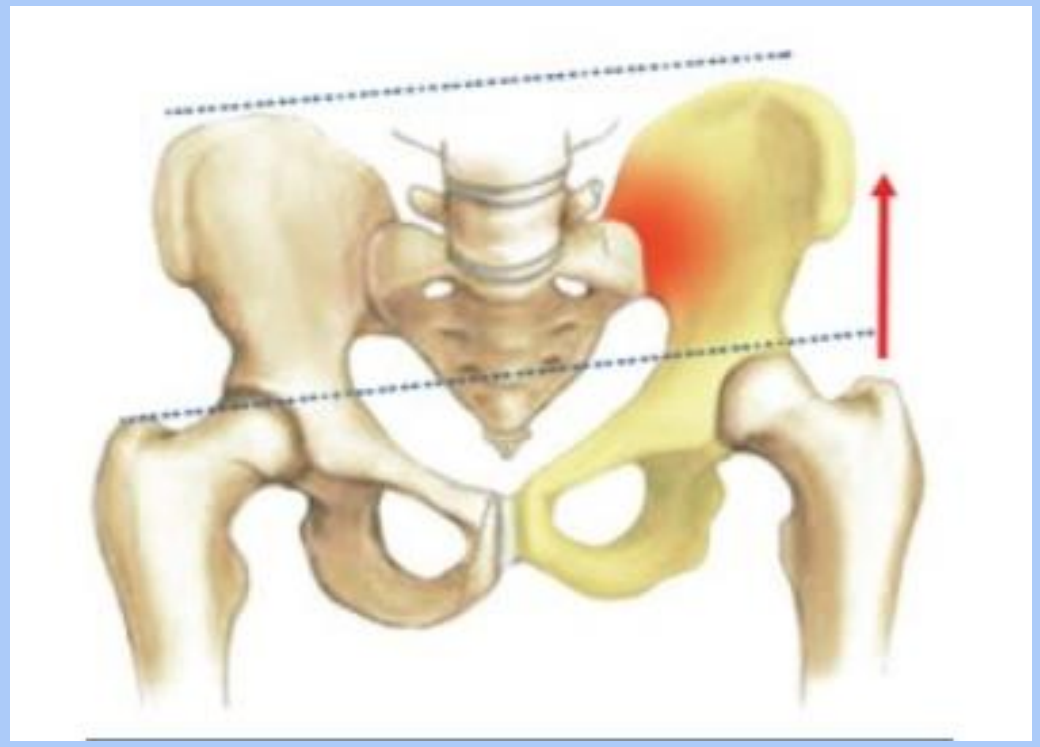
Structural Health-Pelvic Torque



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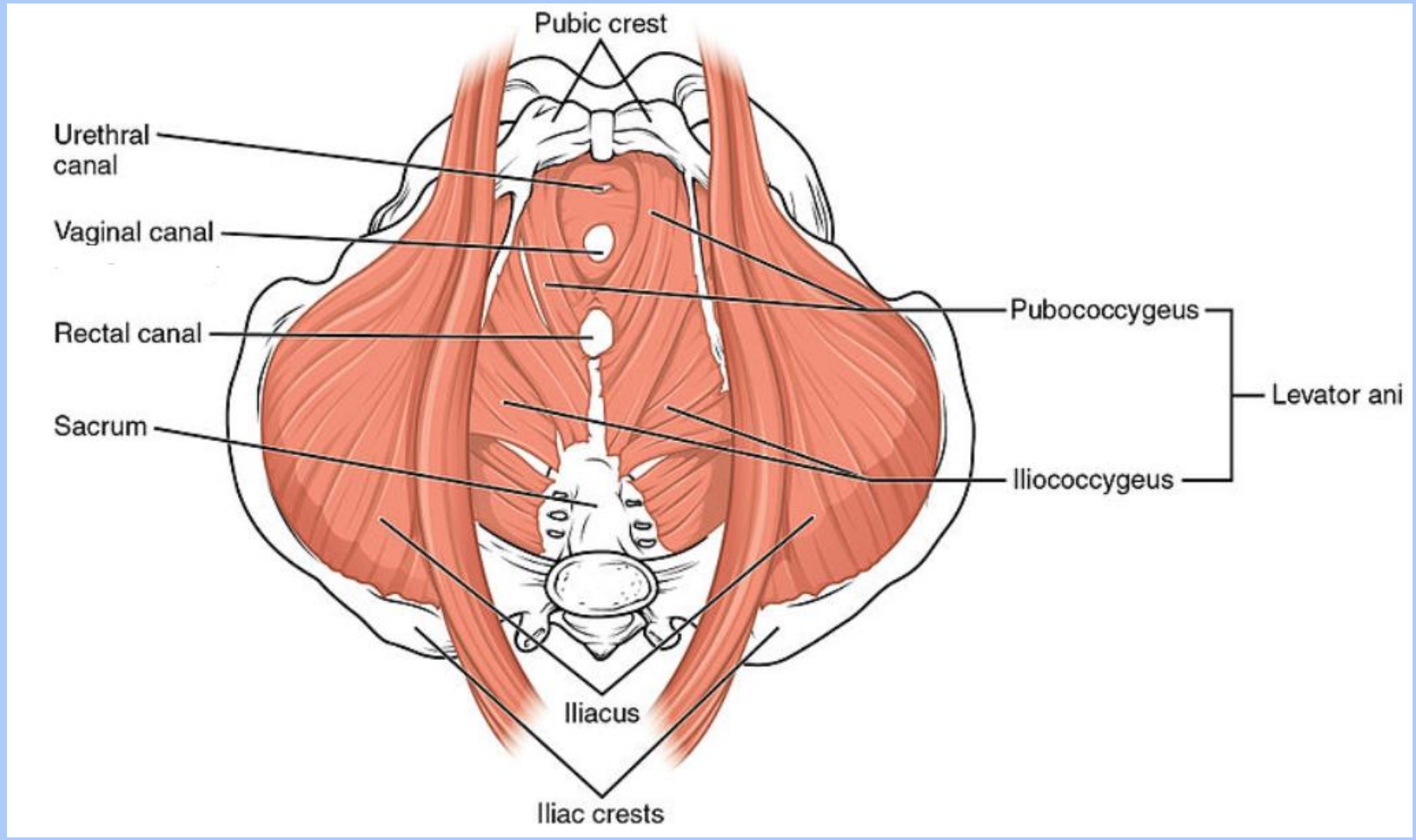
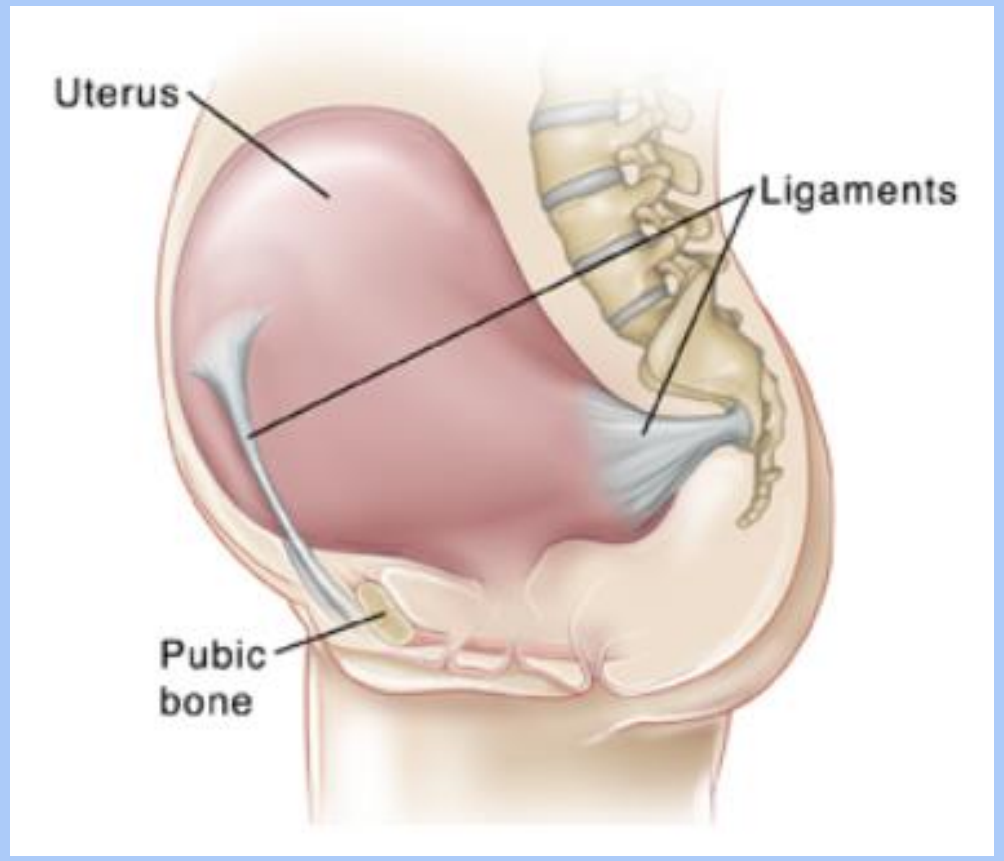
Pelvic Floor



Uterosacral and Round Ligaments

- Anteriority of one side of the sacrum will slacken one and tighten the other uterosacral ligament
- Torque will transfer through the uterus
- Any PI-AS rotation of the pelvis will tension the round ligaments adding to the uterine torque



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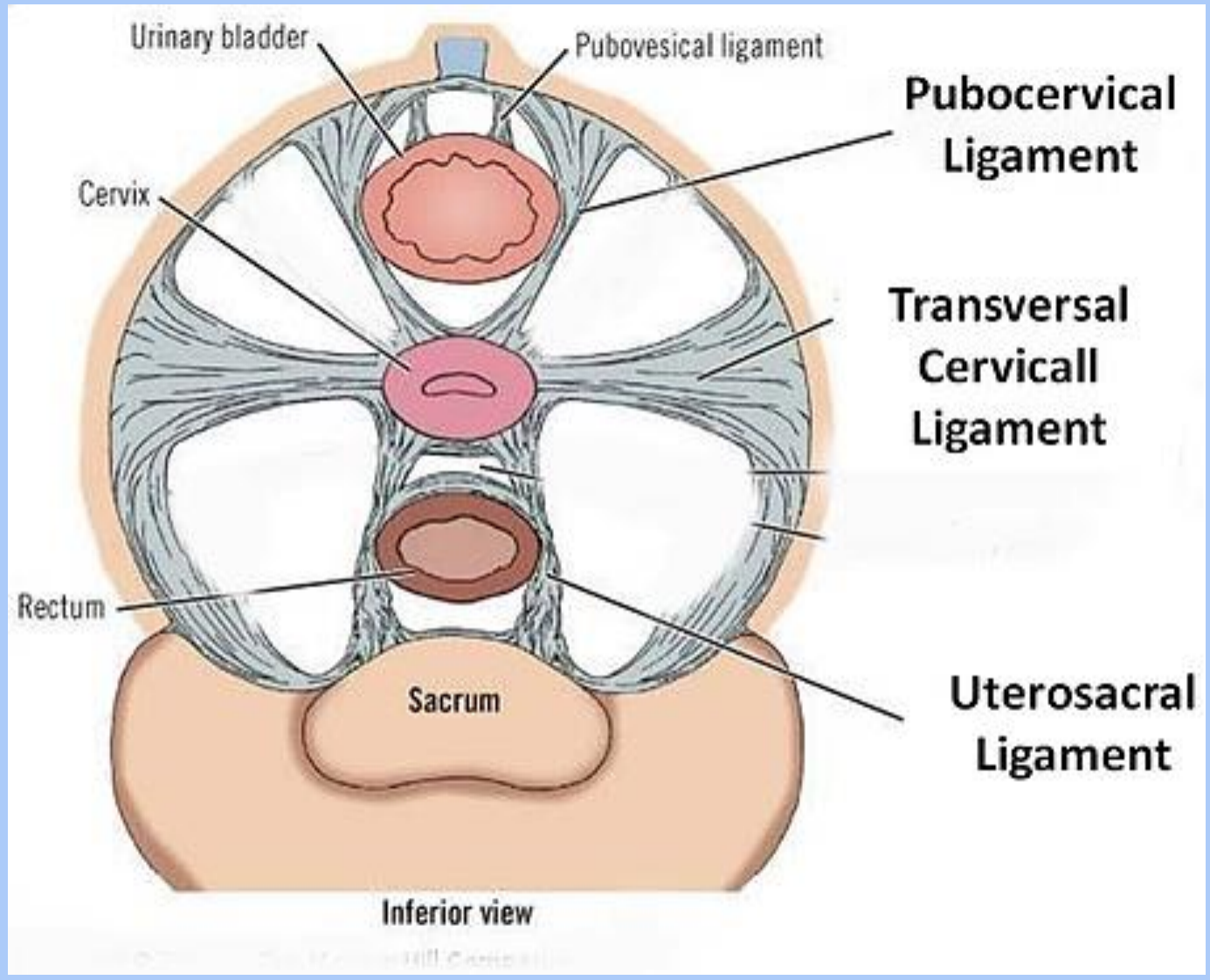
Female Pelvis Section-Showing Ligaments



Birth Trauma-Predisposing Factors

- Oxytocin use
- Malpresentation
- Multiple pregnancy
- Prolonged labour
- Prolonged 2nd stage
- Epidural anaesthesia
- Forceps delivery
- Shoulder dystocia
- Macrosmia

Perlow et al J Reprod Med. 1996 Oct;41(10):754-60.

- Induction of labour at term is associated with adverse outcomes **Grivel et al Acta Obstet Scand 2012 Feb;91(2):198-203**

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Birth Trauma

- Major birth injuries are in the main obvious

  i.e. fractures, plexus lesions, lacerations, organ ruptures, dislocations, facial and other nerve lesions
- *"birth trauma is an under publicised and therefore under treated problem"* ***Gottlieb MS*** **J Manipulative Physiol Ther. 1993 Oct;16(8):537-43**
- Up to 73% of infants had one or more asymmetries at birth 61% head, 42% face and 16% torticollis **Miller et al British J Midwifery 2013 Oct 21;10:736**

Caesarean Section

- C-section deliveries make up 30% of UK births (14% elective, 16% emergency) https://digital.nhs.uk/data-and-information/publications/statistical/maternity-services-monthly-statistics/january-2019#key-facts
- 30% in Australia, 32% USA and 55% in Brazil! **Betran et al PLoS One. 2016; 11(2): e0148343**
- HRV analysis revealed higher cardiovagal modulation in spontaneously born new-borns without analgesia compared to infants born by C-section **Kozar et al BMC Pregnancy Childbirth 2018 Jun 27;18(1):264**

Autonomics

- **Parasympathetic stimulation increases peristalsis and secretory activity and slows heart rate**
- **Sympathetic stimulation slows gut motility and digestive function and increases heart rate**
- The enteric nervous system modulates the activity of the other two systems
- As the infant's sleep cycle lengthens so does the cycle of peristalsis, providing more time for digestion and absorption

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Vagus Nerve Entrapment points

- Skull base
- Sub-clavicular
- Diaphragm

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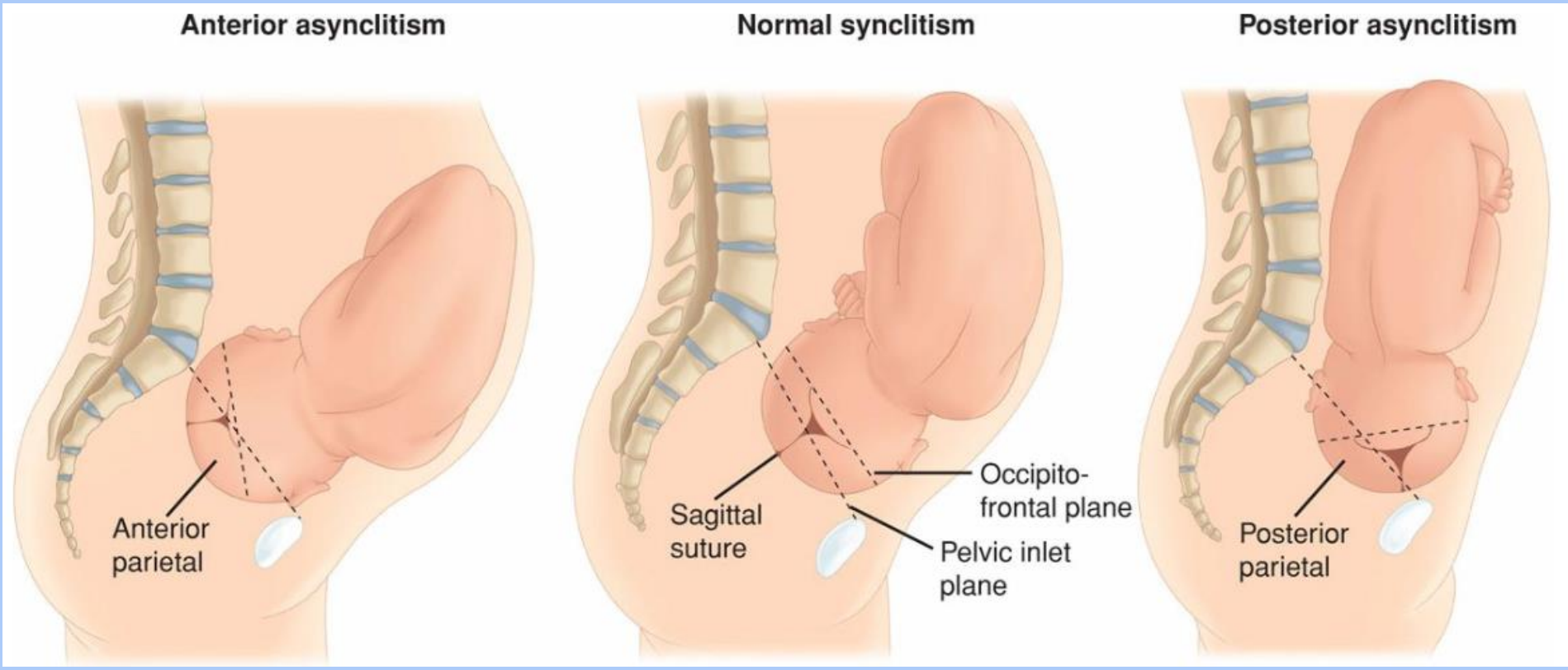
Asynclitism



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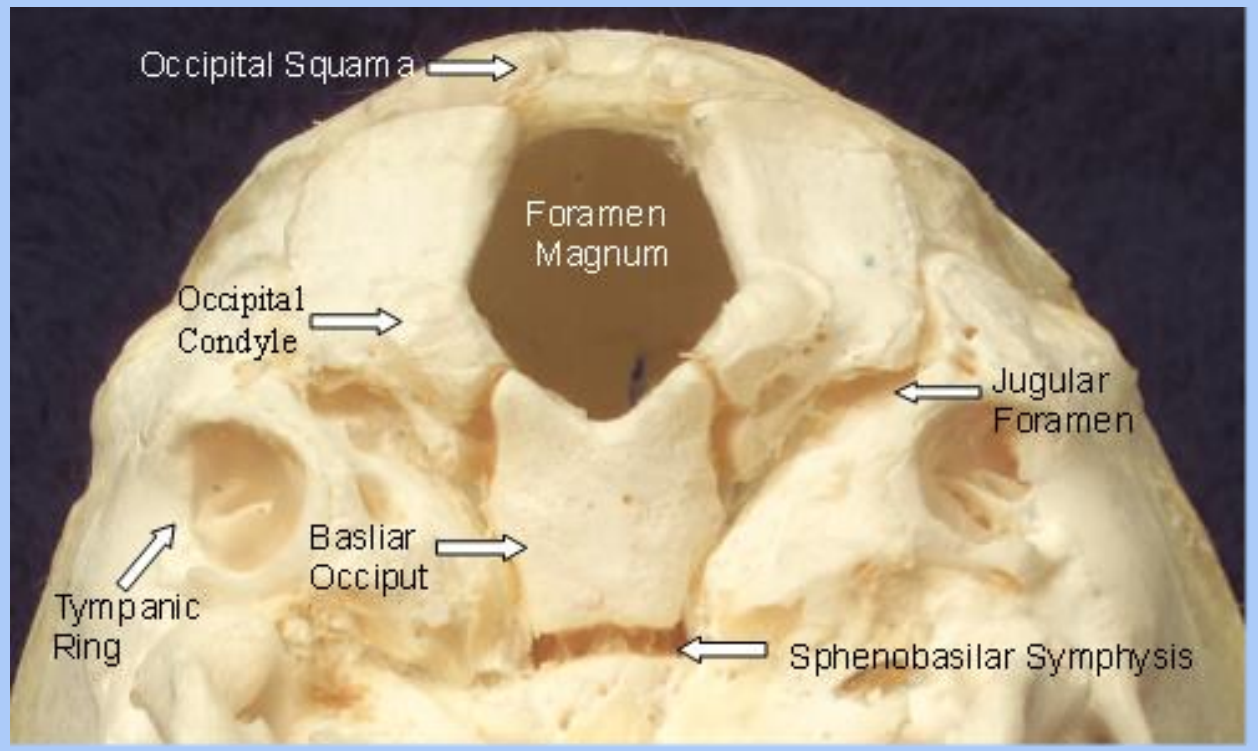
Jugular Foramen Compression

- If a foetus's head is fixed in an asynclistic position during the birth process sub occipital and cranial tissues maybe strained creating jugular foramen compression **Carreiro JE An Osteopathic Approach to Children. 2003 Churchill Livingstone Edinburgh**



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Jugular Foramen Compression

- Heart rate and breathing issues
- Difficulty in swallowing or choking while feeding
- Functional Gastrointestinal Disorders - straining, constipation, reflux, colic
- Increased sympathetic tone
- Torticollis

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Proton Pump Inhibitors-Effects

- The specific adverse effects associated with PPIs were necrotising enterocolitis, late onset sepsis in premature infants, clostridium difficile infection, asthma, obesity, increased spiral fracture risk and small intestine bacterial overgrowth in young children
- PPIs create dysbiosis of the microbiome in the mouth, gut and lungs in the paediatric population **Levy et al Acta Pediatrica 2020 feb 6**

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Microbiome

- Infants delivered by C-Section have a different microbiota to those delivered vaginally which will impact their health **Collado Gut Microbes 2014 01;5(2):271**
- Breast milk is a source of commensal bacteria which further enhance infant health by preventing pathogen adhesion and promoting gut colonisation of beneficial microbes **Lyons et al Nutrients. 2020 Apr 9;12(4).**
- *"bacteria in mother's breast milk seed the infant gut"* **Pannaraj et al JAMA Pediatr. 2017 Jul 1;171(7):647-654**
- More than 200 bacterial species identified in breast milk **Fernadez et al Cell Mol Biol 2013 Nov 3;59(1):31**
- The development of gut microbiota primarily occurs during infancy and is influenced by multiple factors, including prenatal exposure; gestational age; mode of delivery; feeding type; pre-, pro-, and antibiotic use; and host genetics **Li et al Semin Reprod Med. 2014 Jan;32(1):74-86**

Microbiome-HPA Axis

- The composition of the microbiome influences the hypothalamic-pituitary-adrenal (HPA) axis by influencing cortisol secretion **Sudo The microbiota-gut-brain axis in health and disease. New York, NY: Springer; 2014. pp. 177–194**
- Chronic stress reduces the diversity of the microbiome and affects the relative abundance of various types of resident bacteria in a manner that correlates with increases in pro-inflammatory cytokines, including interleukin-6 (IL-6) and tumour necrosis factor-alpha (TNF-a)
  Bailey et al *Brain Behav Immun. 2011 Mar; 25(3):397-407*

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Microbiome-Vagus

- Bacteria in the gut interact with cells in the gut wall to stimulate production of peptides that activate afferent endings of the vagus nerve
- Pro-inflammatory cytokines appear to activate vagal afferent fibres, with vagal transmission of inflammatory signals believed to be a key mechanism by which the brain receives information regarding systemic inflammation
- Efferent fibres of the vagus, in turn, carry anti-inflammatory signals to the periphery, via what is termed the cholinergic anti-inflammatory pathway **Tracey KJ** ***Nat Rev Immunol. 2009 Jun; 9(6):418-28*** **VijayaraghavanPLoS One. 2013; 8(6):e65936**
- *"bidirectional signaling between the gastrointestinal tract and the brain, mainly through the vagus nerve, the so called "microbiota-gut-vagus-brain axis," is vital for maintaining homeostasis"* **Moniel-Castro et al Front Int Neurosc Oct 2013;7:70p1**

Sacrum -Assessment

- Squeeze the buttocks together and any deviation of the gluteal cleft observed
- The cleft will deviate to the anterior sacral side

Sacrum- Correction

- Contact posterior sacrum hold 5-8 seconds P-A pressure
- Finish with fast “flexor flick”
- Stabilise ipsilateral ileum

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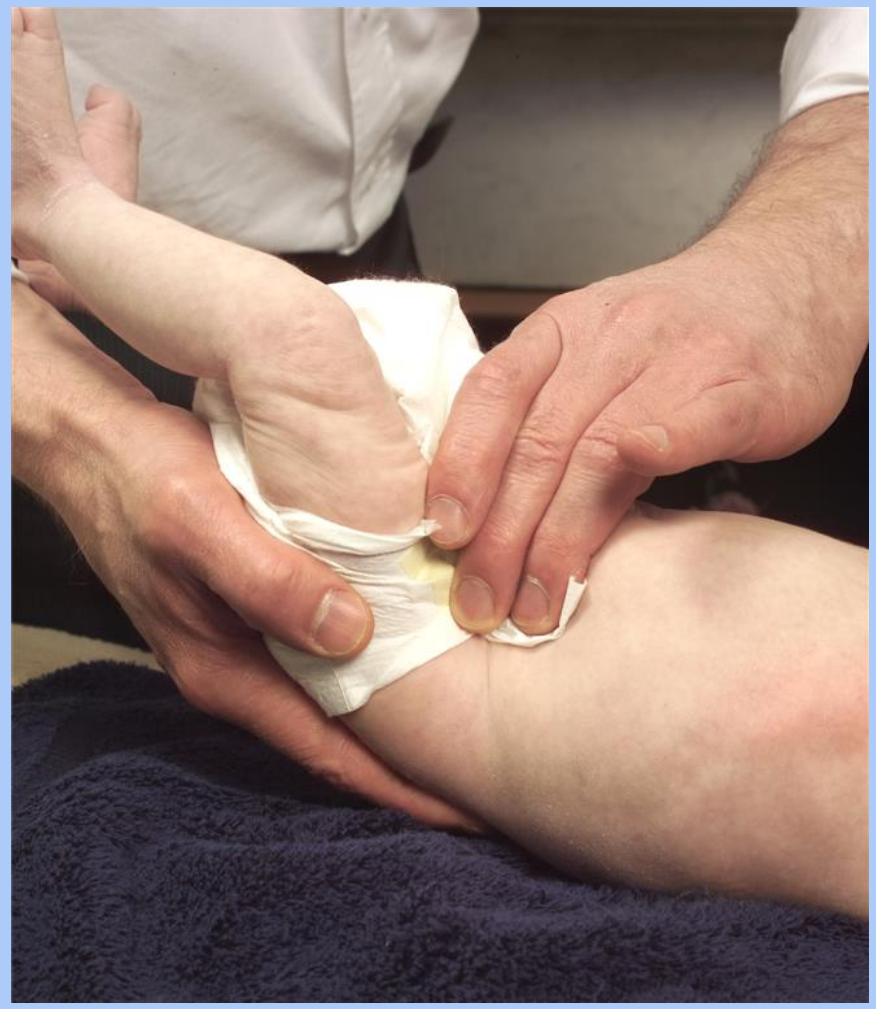
Balancing Sacral Respiratory Function

- Flexion/extension of the sacrum is encouraged while the ASIS's are gently squeezed together to open the SIJ's



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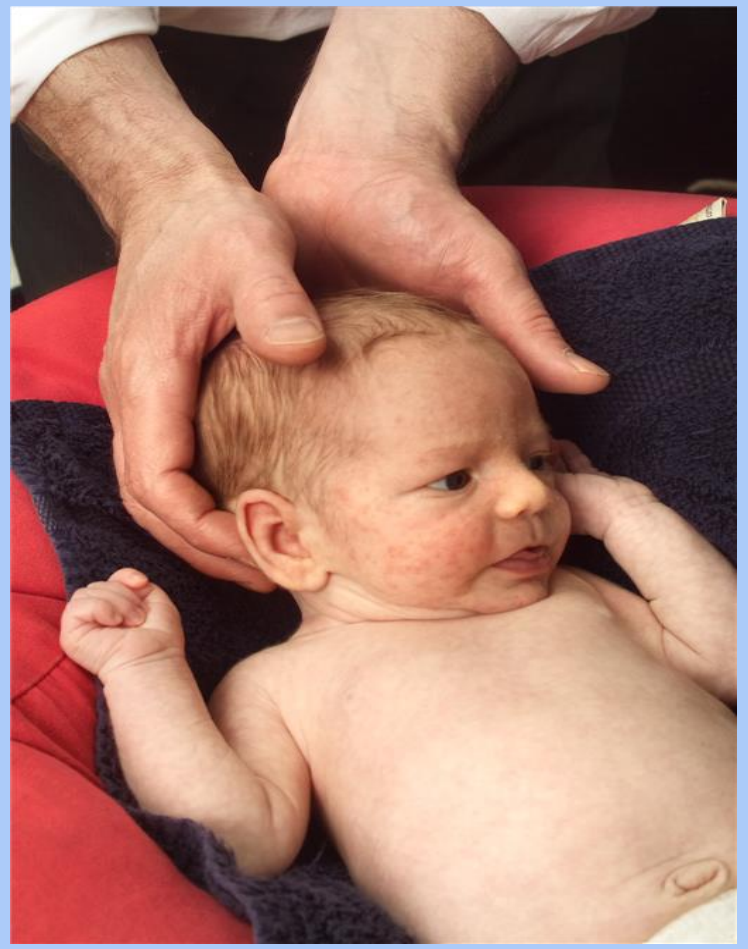
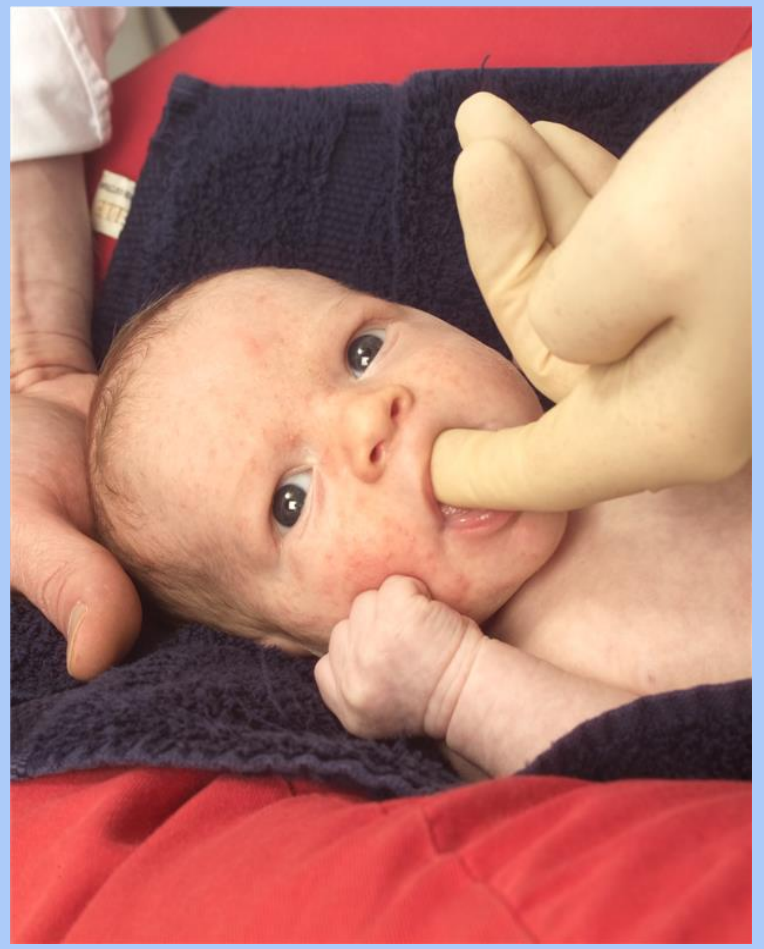
Occipital Decompression





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Occipital Assessment & Correction

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Sphenoid Correction

- The sphenoid greater wings are very gently taken into flexion - anterior/inferior and palpated for pliability
- They are then taken into extension - posterior/superior and tested as above
- If restricted correction is indirect - in the direction of “freedom”

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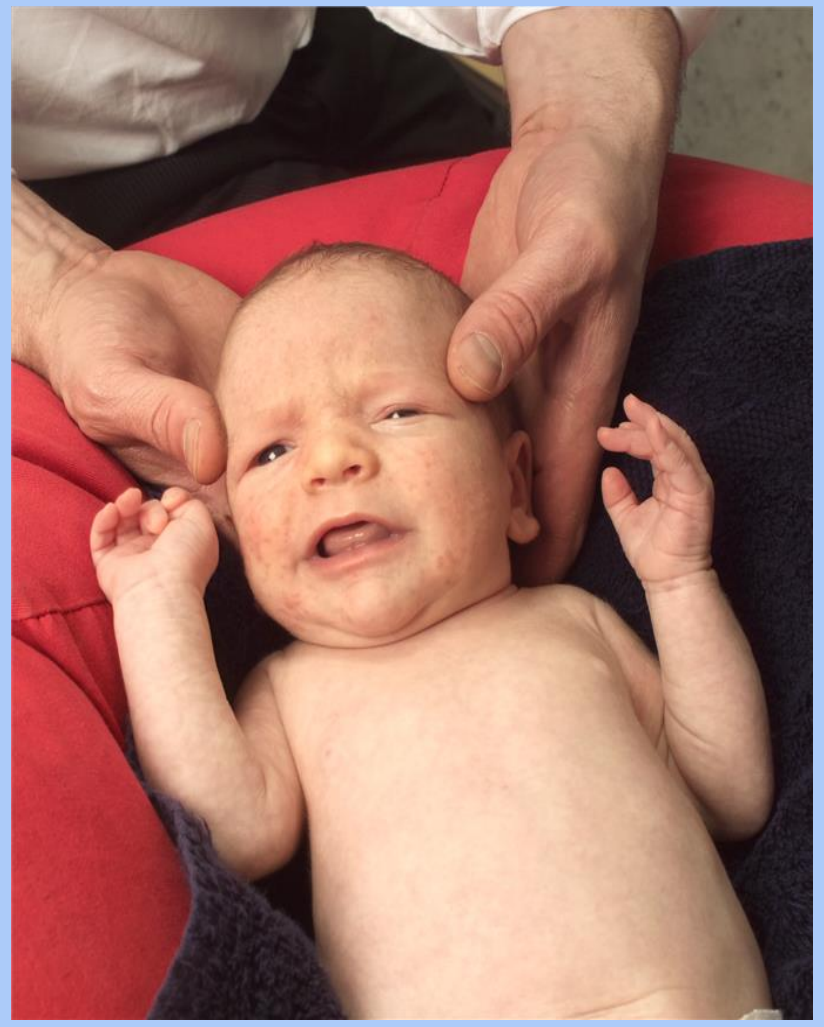
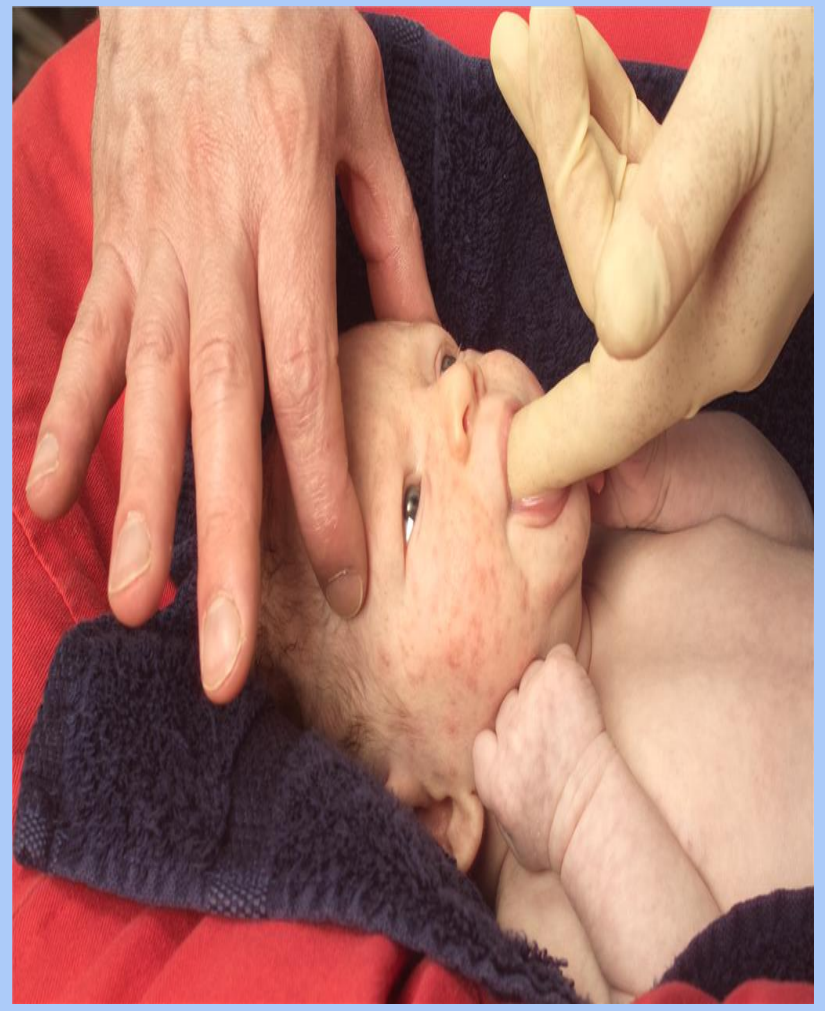
Sphenoid Correction





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Sphenoid Assessment & Correction

Temporal Correction-Ear Pull

- The doctor grasps the pinner of the infant's ear and gently tractions laterally
- If restriction is noted the ear should be unwound in the direction of freedom

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Temporal assessment & Correction
Ear Pull

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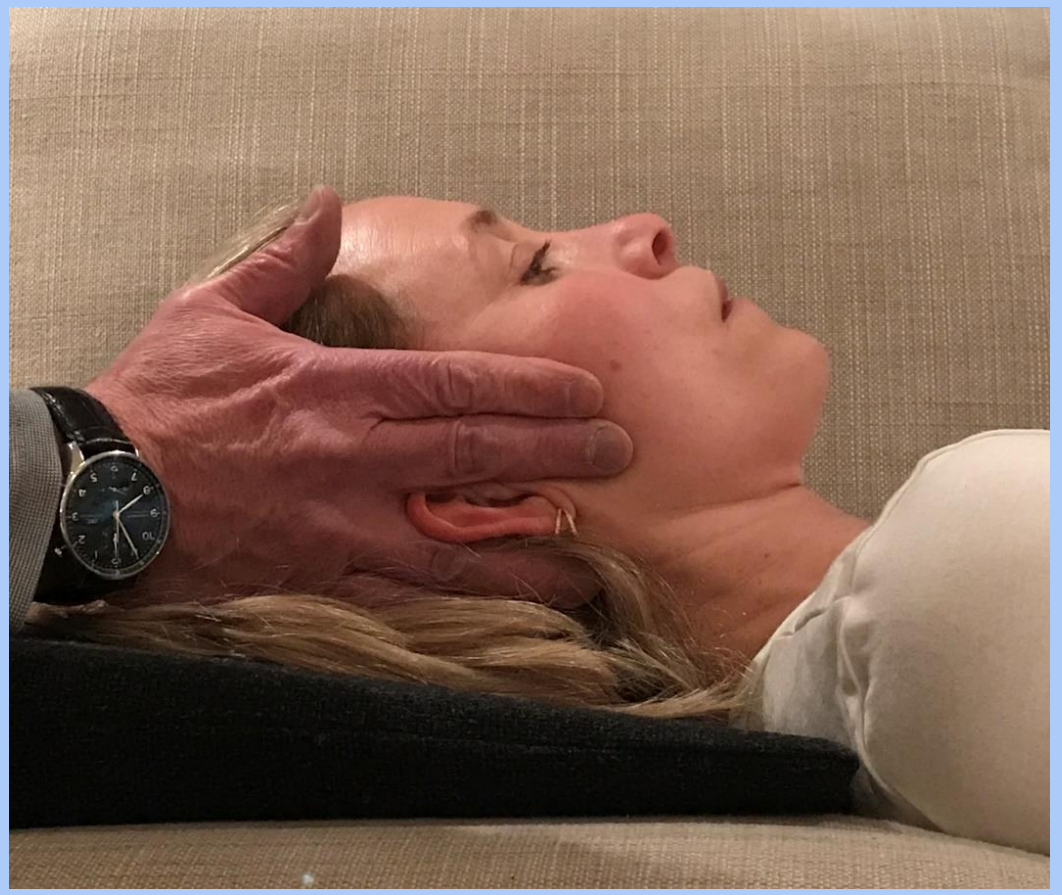
Temporal V Technique

- Contact temporal with 1st phalanx 3rd and 4th fingers
- Test for restriction
- Release in the direction of ease



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Temporal V Technique

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Rosenberg's "Ventral Vagus" Release

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Testing JF Compression

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JF Decompression

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Post JF Decompression Test

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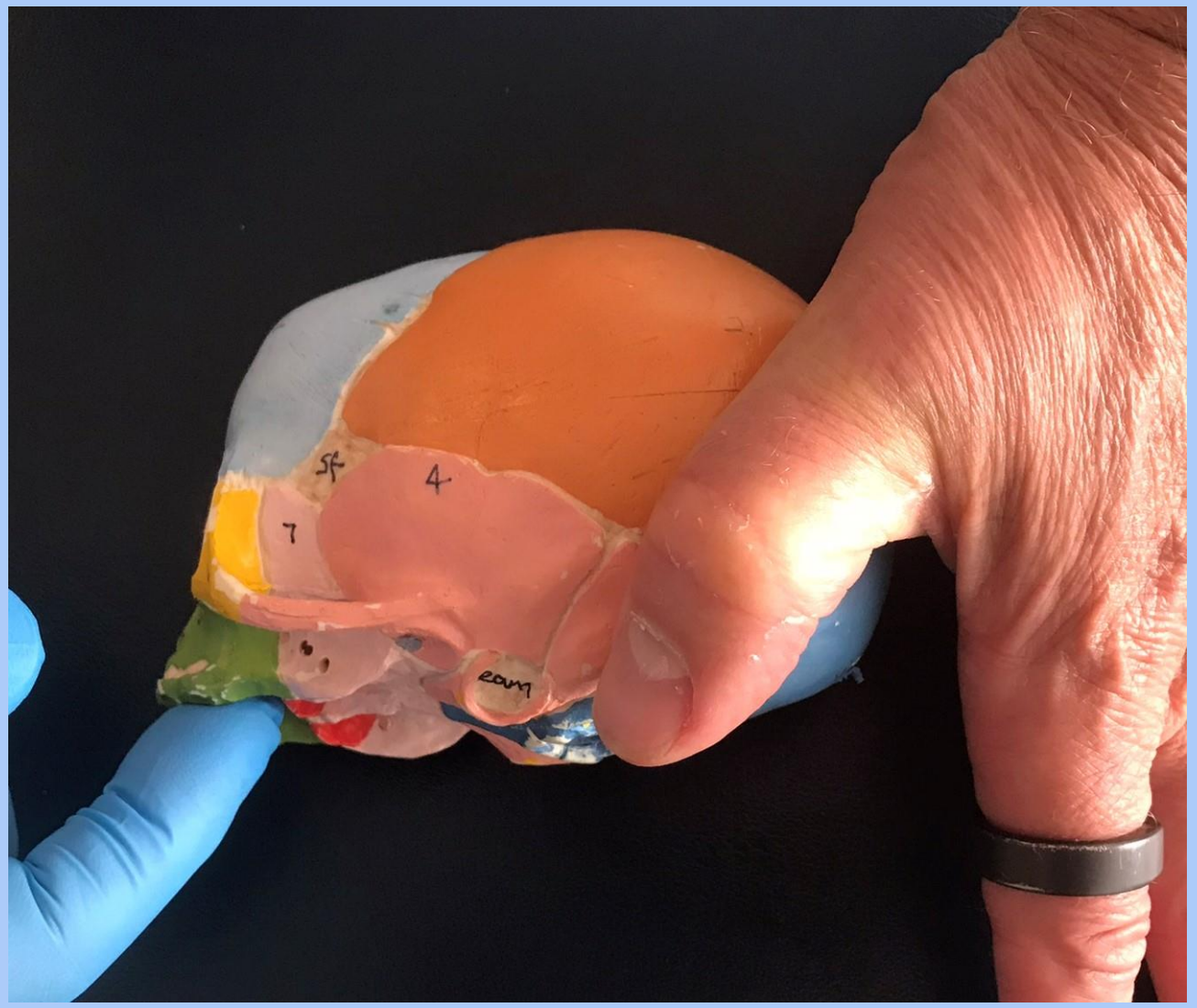
Infant Jugular Foramen Release



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In Conclusion

- Skull base mechanics are vital to parasympathetic function and can affect digestion, heart and lung function, mediation of the stress response, sleep, immune function and the development of and communication with the microbiome