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Mini Review

Outlining a Functional and Nutritional Model of Craniofacial Growth

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Today, the way we understand dental arch growth has exploded. Crooked teeth and impacted wisdom teeth are the endpoint of poor skeletal growth. Our teeth are the victims of the platform they live in.

When a child now walks into the dental practice, crooked teeth can be assessed in a completely new way.

Dental growth is a function of breathing, airway and postural influences on teeth. Jaw growth is directed by feedback from the tongue, nasal airways and facial muscles.

One way to think of this as your teeth being the ball in a football game. They're being kicked around by the forces of the tongue, breathing and facial muscles. The dental arch isn't passive, but a functional feedback system.

That's why if you don't wear a retainer after treatment with orthodontic braces, the teeth can move. This is due to an underlying functional problem.

Nasal breathing has an expansive force on the upper jaw [1]. Your tongue should press up against the palate, which forms the floor of the nasal airways. These forces, with proper closed lip, muscle posture, influence the growth of 'straight' teeth.

Why every moment matters in kid's dental growth

Let's go right back to the start of the problem and really understand how crooked teeth happen.

Breastfeeding is a major influence on jaw growth. It also trains a child in nasal breathing. Their tongue extracts milk by pushing the nipple to the roof of the mouth. These forces expand their palate. Breastfeeding has been shown to decrease risk of crooked teeth [2]. It's the start of a lifetime of factors that influence jaw size.

Your child's ability to breastfeed may be due to their oral development. Ideally, the first dental exam should occur right after birth. This reveals oral restrictions, such as tongue or lip ties, which could hinder their ability to push their tongue up against the palate [3]. Dentists, surgeons and ENTs can now diagnose and release tongue-ties to assist breastfeeding.

Your child continues to develop their oral muscles, lip closure, tongue posture (sitting against the palate) and breathing all influence their growth.

The standard orthodontic approach has been to delay action until the adult dentition has formed. In some cases, teeth are extracted and the remaining teeth straightened with braces to fit into small jaws. But this approach fails to address what caused the problem in the first place.

And our small jaws prevent us from breathing properly. Rates of sleep disorders have been increasing in the last two decades [4]. Without the frame to support airways when muscles relax at night, we are starving our brains of oxygen.

The end stage is obstructive sleep apnea that is linked to high blood pressure, heart failure [5], and brain disease [6]. But upper airway resistance is a less recognized and diagnosed breathing disorder [7]. It's also a driver of digestive disorders, anxiety, poor circulation and a host of other symptoms [8].

Our airways aren't only stuck in small jaw-bones, they also have swollen soft tissues. In many people, especially children, airways are also inflamed, swollen and clogged with mucus. Allergic rhinitis, asthma, swollen adenoids, and tonsils are barriers to nasal breathing [9].

The oral and gut microbiome play a crucial role in how bacteria mediate the immune response. Since 2008, the scientific world has been sequencing this foreign yet symbiotic 'organ' that lives in the body. Imbalanced microbes cause intestinal barrier dysfunction, which is linked to digestive, autoimmune and metabolic disorders [10].

The umbrella of crooked teeth has far reaching health problems. Expansive airway focused orthodontics can guide jaw growth [11]. This not only straightens teeth but considers facial and airway development.

Childhood dental development can now be guided by a team, right from birth. This includes lactation consultants, dentists, myo-functional therapists, airway orthodontics, sleep physicians, and ENTs. Functional oral health has helped us see malocclusions are NOT inevitable.

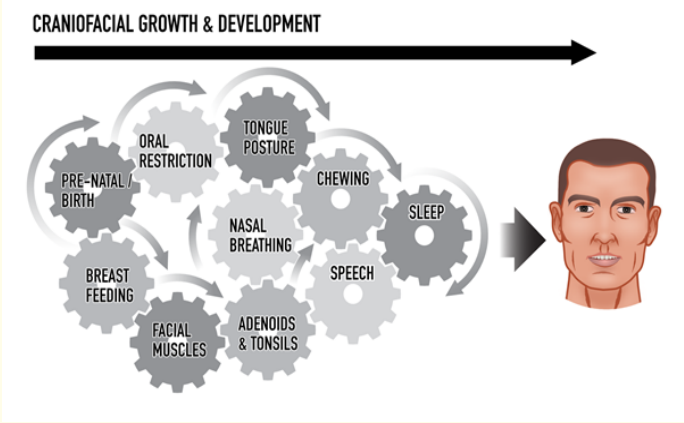

Figure 1

Searching for the 'yolk' of crooked teeth

The fluid model of jaw and facial growth digs deeper into how crooked teeth occur.

But it doesn't answer why.

This is where Price was well ahead of his time. He had found the why. Now we need to connect his theory to what science has since revealed.

Anthropologists, such as Robert Corruccini have long confirmed that malocclusion is linked directly to historical changes to the human diet [12]. The human fossil simply lacks crooked teeth before farming and industry.

The history of dental disease in humans

An evolutionary, ancestral perspective is an important missing piece of the puzzle. It also helps us to dig past the 'egg white' layer.

In modern day, it may be that neonatal jaws are failing to develop in the womb [13]. During growth in the womb, the fetus goes through 3D skull growth [14].

Pregnant women have a higher risk of sleep apnea [16] and a mother with crooked teeth may deliver less oxygen to her child. We know the relationship between low oxygen and fetal growth. This could be similar to smoking during pregnancy, which curbs the growth of the fetus [15].

Mother's with small jaws may have kid's with small jaws. But why didn't the jaw grow in the first place?

Nutrition as the driving factor for jaw growth

Malocclusion is linked to a major change in our food supply. The cranial and jaw development problems I see are linked to our diet. Price had figured this out; his theory is our 'yolk'.

Throughout human history, a typical diet delivered foods rich in the fat-soluble vitamins D, A and K2. Today, these vitamins are sadly lacking from the modern diet. Vitamin D deficiency has been dubbed a global pandemic [17].

Price's work inspired me to begin testing all my patients with tooth decay, gum disease and malocclusion. All were insufficient, and some were deficient in vitamin D.

He also noted the importance of pre-pregnancy nutrition. Vitamin D intake starts in utero and the mother carries on passing her Vitamin D to her child if she breastfeeds [18]. In children, low vitamin D levels have been related to tooth decay [19] and adequate vitamin D may be linked to lower rates of decay [20]. A small amount of research has shown supplementation may prevent caries.

Bone growth is being directed by a child's stores of vitamin D. Vitamin D deficiency in children is known to cause growth retardation [21].

Vitamin D also directs cellular growth, binding to and influencing thousands of genes [22]. And perhaps critically, deficiency in Vitamin D directs the epigenome [23].

For a long time, Price's fat-soluble vitamins theory lacked a physiology model to support it.

However, with the help of many arms of science, we now understand crooked teeth as a food driven outcome.

The traffic lights of growth and development

To better understand crooked teeth, let's look at how the human body develops right from birth.

As the fetus grows, it develops different systems such as spinal cord, skeletal system and organs in an established order, with progress checkpoints. However, if one part of the body hasn't finished, it can't afford to wait; the show must go on.

For instance, spina bifida is due to failure to close the neural tube. These checkpoints occur around the 23rd and 27th days of pregnancy [24]. With adequate folate, a building block of the nervous system, the body completes its work correctly and moves onto other systems. Without enough folate, the job is left incomplete, and the child with an exposed spinal cord.

As the craniofacial system develops, it too has a series of progress checkpoints. When a child reaches a certain stage, whether inputs have been sufficient or not, the growth stages move on. A small or narrow dental arch has been left 'unfinished' like a spinal cord in spina bifida.

The fat-soluble vitamins – the 'bricks and mortar of teeth'

Price's theory centered around the trilogy of fat soluble vitamins. K2 wasn't identified as activator X until 2007 by Chris Masterjohn. Masterjohn has since fleshed out much of their three-way synergy in the body.

Now we have reached the final pieces of the puzzle.

Let's look at the ways that these vitamins work together to direct bone and teeth growth.

Vitamin D

Vitamin D deficiency and its impact on the skeletal system is firmly established. Osteoporosis and rickets in children (which occurs when bones don't mineralize properly) are well known. Vitamin D is the main conductor of minerals in the body and vital for calcium balance.

90% of the population now have impacted wisdom teeth.

Jaw growth, like any other bone growth, is three-dimensional. In order to erupt, teeth rely on overall space in the jaw – length, but also the width of the bone [25].

To gain width, the bone must go through 'appositional' growth. This builds the thickness of the bone and that happens in late stage development of the jaw and houses the wisdom teeth [26].

Today, many children's bodies seem to lack both the raw materials and the signals to keep this growth process growing. The jaw bones are less developed in all dimensions and wisdom teeth simply don't 'fit'.

Vitamin A

While bones are growing, they must remain functional. Growing bones must also support joint movements. Bone growth is a material-hungry remodeling process that must break up active bone before adding new layers.

Price established the absence of foods rich in vitamin A in the modern diet. Vitamin A activates osteoclasts that disrupt these bony surfaces to stimulate growth [27].

Vitamin A also influences gene regulation, vision, reproduction, cell division and cell differentiation, and works with Vitamin D throughout the body [28].

Vitamin K2

While vitamin D supplies the materials, vitamin A supplies the workers that keep the process running. Together, they activate the proteins that stimulate demand for vitamin K2 [29].

Like vitamins D and A, vitamin K2 is passed on to a child by their mother [30]. It activates the protein osteocalcin that carries minerals into bones. Once osteocalcin is activated by K2, its receptors for calcium 'open' and allow it to carry minerals into bone and teeth [31]. It works with vitamin D in osteoblasts to produce bone [32].

Another protein activated by K2 is MGP protein. MGP protein has the task of stopping minerals going into the soft tissues, including vascular tissues [33].

Rats show that septal calcification may cause deviated septum which may prevent the functional growth of the maxilla by reducing nasal breathing [34]. However, studies need to confirm this relationship [35].

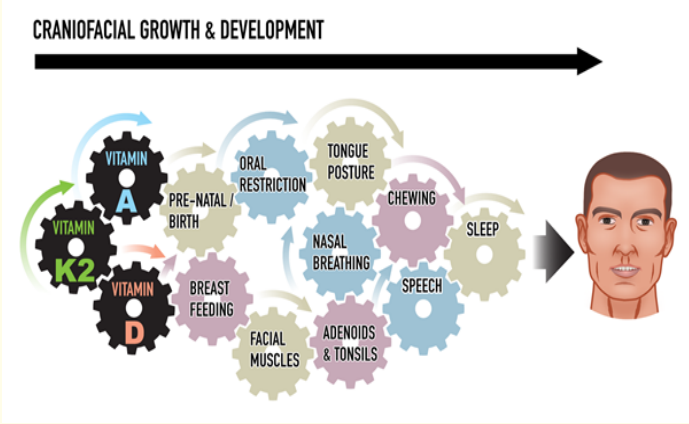

Figure 2

The nutritional model of malocclusion

Food is the primary cause of crooked teeth. Oral health should be our primary concern when creating dietary guidelines.

Many factors combine to influence jaw and teeth growth, and many nutrients combine to influence the body and its development. To date, nutrition research has focused on the action of one vitamin and one outcome. However, the fat-soluble vitamins work together in a system.

A reductionist approach that studies how nutrients work in isolation fails to account for the complexity of the human growth and development.

Today, with the benefit of ancestral, the human microbiome and epigenetics, we can progress forward with a complete explanation for his theory.

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US Retrospective study of malocclusion in WAP raised children: New York/New Jersey

WAP Chapters Leaders: Manhattan, New Jersey

Malocclusion (crooked teeth) affects upwards more than 75% of children today. In my dental practice, I don't see children grow jaws that can house 32 teeth.

As a pilot study, we are seeking children who grew up with the WAP philosophy of nutrition. Our purpose is to document what impact the WAP diet has on facial, jaw and dental development. The study will compare children raised with the WAP philosophy against population norms.

It will consist of:

- A historical questionnaire
- A diet questionnaire
- An orthodontic assessment

The study will assess children 10 - 18 years of age with a parent who has been a member of the WAP foundation their entire life.

The exam will be FREE OF CHARGE and parents can choose whether to allow specific details of their child's case to be used in subsequent publications. If preferred, the measurements will be used in data and no personal details of their child will be published on any medium.

Please send interest and questions to:
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Dr Steven Lin 'The Dental Diet' will be available in January 2018. For more information please visit his website.

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