

Dr. Steven Lin

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## Vitamin K2 Deficiency Effects on Your Smile



*If you had crooked teeth, or needed braces it's a sign of nutrient deficiency. Which nutrient? Vitamin K2.*

### **Part 2E: How Vitamin K2 Fuels Jaw Growth**

One of the biggest problems of modern dentistry has been a failure to address the cause of crooked teeth (<https://www.drstevenlin.com/crooked-teeth-link-vitamin-a-and-allergies/>). However, as we'll find out, nutritional science has misunderstood the vitamin that caused the problem in the first place.

Today, at least 75% of kids have some level of dental malocclusion (<https://www.drstevenlin.com/causes-crooked-teeth-kids/>). Many patients ask me, "Are crooked teeth genetic?"

If they were, this wouldn't explain how prevalent the problem is today.

Are crooked teeth caused by genes? The resounding answer is **NO**. When we look at the human jaw record, crooked teeth weren't present for the majority of the time humans have walked the earth.

So, how did our teeth *become* crooked? The answer is simply our *diet*.

Eating For Alignment: Nutritional Strategies To Prevent Crooked Teeth | Dr Steven ...



The story of Vitamin K2 has helped mask the true cause of malocclusion (crooked teeth).

Diets lacking in the fat-soluble vitamins, in particular Vitamin K2, have resulted in the widespread stunting of jaw growth.

In this article on Vitamin K2, we're going to look at Vitamin K2 deficiency, jaw growth and how your diet can prevent orthodontic braces.

## How Vitamin K2 guides jaw growth

Vitamin K2 impacts facial development in 4 ways:

- Nasal septum deviation
- Bone growth and density
- Growth hormone and insulin-like growth factor
- Testosterone and sex hormone levels

## Vitamin K2 and the causes of nasal septum deviation

The most common observation in kids that need braces is that they often mouth breathe (<https://www.drstevenlin.com/oxygen-deprivation-puts-kid-risk-adhd/>). There are many obstacles to proper nasal breathing. A deviated septum may be one, and often increases the risk of crooked teeth.

The upper jaw or maxilla is the central pillar for the growth of the face and dental arch. Nasal breathing is a factor in the growth of the maxilla. (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2741199/>) A deviated septum can make nasal breathing difficult, and so may link to poor facial growth (<https://www.ncbi.nlm.nih.gov/pubmed/21495046>).

Some figures show that up to 20% of school age (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4042609/>) kids have nasal septum defects. During their school years, a child's jaw is going through critical growth stages.

In childhood, the cartilage of the nasal septum should remain flexible and finalize development at 16 in girls and 17 in males (<https://www.ncbi.nlm.nih.gov/pubmed/19075124>). Septum defects may be due to early calcification and loss of this flexibility.

Early nasal calcification is linked to Vitamin K2 through its activation of Matrix-GLA protein, which prevents soft tissue calcifying. In one child exposed to Vitamin K inhibitor (warfarin during pregnancy), poor nasal cartilage development (<https://www.ncbi.nlm.nih.gov/pubmed/9286443>) has been observed. This has also been observed in fetuses (<http://www.sciencedirect.com/science/article/pii/S0735109799000443>).

In mice (<http://www.jbc.org/content/early/2017/05/09/jbc.M116.769802.full.pdf>), stunted facial growth has been found in Matrix-GLA deficient mice. By expressing Matrix-GLA protein locally in the cartilage, correction of the facial growth was also achieved.

## **Vitamin K2 in bone metabolism**

In 2001, the Institute of Medicine increased dietary reference intakes of Vitamin K to 90 microg/d for females and 120 microg/d for males, an increase of 50% from previous recommendations.

While further large-scale trials are needed, Vitamin K2 has been shown to increase bone density (<https://www.ncbi.nlm.nih.gov/pubmed/11684396>). It's thought that it controls bone density through Vitamin K2-dependent osteocalcin and calcium balance.

Studies show that Vitamin K decreases fracture risk (<https://www.ncbi.nlm.nih.gov/pubmed/17906277>). The authors of this study suggested that health professionals monitor the bone density and diet of patients on Vitamin K antagonists such as warfarin.

Vitamin K2 also interacts with human growth hormone (GH) to signal jaw growth. Animal studies show that it directs the size of the marrow cavity in bones in rats. (<https://www.ncbi.nlm.nih.gov/pubmed/17187193>)

Crucial to calcium balance and bone metabolism, Vitamin K2 also influences the hormonal signals of bone growth.

## Vitamin K2 and growth hormones

Vitamin K2 directs the hormonal signals of bone growth with three other factors:

- Growth hormone (GH)
- Insulin-like growth factor (IGF-1)
- Vitamin D (<https://www.drstevenlin.com/the-health-benefits-of-vitamin-d/>)

Bone growth is directed by cartilage cells on the growth plate. Both GH and insulin-like growth factor (IGF-1) are key signalers.

Growth hormone, IGF-1 and Vitamin D have a three-way interaction in bone growth (<https://www.ncbi.nlm.nih.gov/pubmed/28372721>).

Growth hormone is released by the pituitary gland and signals the liver to release IGF-1. Vitamin D interacts at both of these levels, and growth hormone affects Vitamin D levels.

Growth hormone activates Vitamin D in the kidneys, so unsurprisingly, patients with growth hormone deficiency can also suffer from Vitamin D deficiency. In turn, Vitamin D deficiency also decreases IGF-1.

One study showed that 7000IU Vitamin D3 (<https://www.ncbi.nlm.nih.gov/pubmed/24005315>) per week increases blood IGF-1 levels. The body appears to need Vitamin D to actively release IGF-1 from the liver. Better Vitamin D status may guide normal levels of IGF1 in growth hormone deficiency.

So how does Vitamin K2 interact in the GH -> IGF-1 -> Vitamin D process?

In rats given GH and Vitamin K2, increased bone turnover and increases bone mass (<https://www.ncbi.nlm.nih.gov/pubmed/17187193>) were seen.

A 2012 study (<https://www.ncbi.nlm.nih.gov/pubmed/22392526>) looked at Vitamin D3, insulin-like growth factor, Vitamin K1 and Vitamin K2 in post-menopausal women. It separated them into three groups for the random controlled trial:

- All groups got 800 mg of Calcium and 400 IU of Vitamin D
- One group also had 100 micrograms of Vitamin **K1**
- One group also had 100 micrograms of Vitamin **K2**

Researchers found that Vitamin D and calcium by themselves increased IGF-1 and overall bone density, but not lumbar bone density.

In both Vitamin K groups, lumbar bone density and activated osteocalcin increased.

It was supposed that activated osteocalcin was a key factor in Vitamin K dependent groups.

## **Vitamin K2 and sex hormones**

Sex hormones, in particular testosterone, are pivotal for jaw bone growth.

IGF-1 is a factor in mandible growth and testosterone increases IGF-1 in jawbones of mice. (<https://www.ncbi.nlm.nih.gov/pubmed/10098530>)

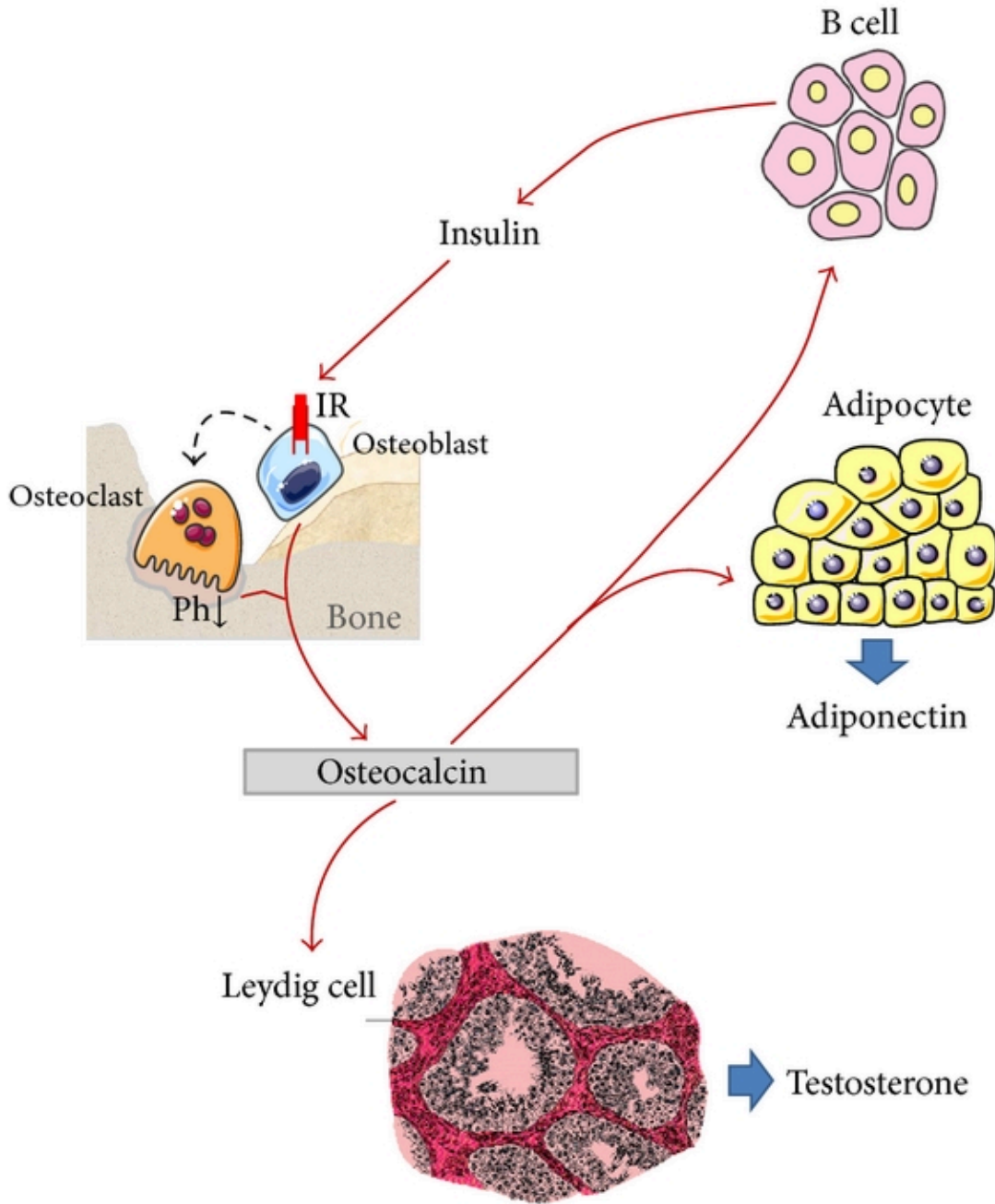
Circulating levels of testosterone have also been linked to facial structure in young adulthood. In boys with growth deficiencies (<https://www.ncbi.nlm.nih.gov/pubmed/10327737>) and low testosterone, low dose testosterone accelerates or 'catches up' craniofacial growth, or normalizes facial features.

Vitamin K2, particularly the MK-4 variant, plays a key role in steroid or testosterone production in the testis.

In rats (<https://www.ncbi.nlm.nih.gov/pubmed/16844298>), Vitamin K2 deficiency decreases testosterone levels. Other studies (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3180407/>) have shown that Vitamin K2 MK-4 increases testosterone levels in the blood and testis.

Also, compared to Vitamin K1, Vitamin K2 MK-4 has been shown to significantly increase testosterone production (<https://www.ncbi.nlm.nih.gov/pubmed/21914161>). Vitamin K1 does not have the same benefit.

The reason seems to be related to levels of activated osteocalcin (undercarboxylated (<https://www.hindawi.com/journals/ije/2013/846480/>)) (<https://www.hindawi.com/journals/ije/2013/846480/>). Vitamin K2 is responsible for activating osteocalcin to this form in the blood to boost testosterone production.



**How the Vitamin K2 dependent protein osteocalcin releases testosterone: Source**  
 (<https://www.hindawi.com/journals/ije/2013/846480/>)

One 20-year study (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4614768/>) showed the relationship between prenatal testosterone and facial growth features.



In rats, (<https://www.ncbi.nlm.nih.gov/pubmed/9730273>) teeth development and skull size were altered in castrated vs. non-castrated rats.

**Vitamin K2 is an approved as an anti-osteoporotic medicine (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4042573/>) by the Japanese Ministry of Health.** In the skeletal system (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2680613/>), sex hormones have a critical role in bone density. Several randomized control studies show higher testosterone levels in both genders are linked to reduced hip fracture risk and risk of falls through muscle strength and balance.

One animal study produced showed Vitamins K2 and D prevented fractures caused by osteoporosis. (<https://www.ncbi.nlm.nih.gov/pubmed/12077663>)

## **Vitamin K2 for straight healthy teeth**

More human studies are needed to confirm the dosage of Vitamin K2 for jaw growth. However, the broad range of research supports its role in normal facial growth and straight teeth.

Problems associated with malocclusion and crooked teeth stay with people for life. The fundamental role of Vitamin K2 in the skeletal system means it should be at the center of a strategy to prevent crooked teeth in future generations.

This article outlines the central thesis of my book, *The Dental Diet* (<https://www.drstevenlin.com/the-dental-diet>), which details how our diets have caused this 'epidemic' of orthodontic problems.

Now I want to hear from you. Did you need braces? Do you eat enough Vitamin K2?

Want to know more? Dr Steven Lin's book, **The Dental Diet**, is available to order today. An exploration of ancestral medicine, the human microbiome and epigenetics it's a complete guide to the mouth-body connection. Take the journey and the 40-day delicious food program for life-changing oral and whole health.

Click below to order your copy now:

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Canada INDIGO (<https://www.chapters.indigo.ca/en-ca/books/the-dental-diet-the-surprising/9781401953171-item.html?ikwid=The+dental+diet&ikwsec=Home&ikwidx=0>)

Now we want to hear from you. Please leave your questions in the comments below.

For more information on Dr. Lin's clinical protocol (<https://www.drstevenlin.com/healthy-mouth-healthy-body-challenge/>) that highlights the steps parents can take to prevent dental problems in their children: Click here. (<https://www.drstevenlin.com/healthy-mouth-healthy-body-challenge/>)

## References:

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## 6 Responses



**Tania** says:

January 14, 2018 at 6:35 pm (<https://www.drstevenlin.com/vitamin-k2-deficiency-effects/#comment-2227>)

Dr Lin, what K2 dosage do you recommend for children? Should a K2 supplement also contain D3? Are there any Australian brands you can suggest?

Reply



**Dr Steven Lin**  
(<https://www.drstevenlin.com>)

January 14, 2018 at 10:08 pm (<https://www.drstevenlin.com/vitamin-k2-deficiency-effects/#comment-2228>)

says:

Hi Tania, summarised here: <https://www.drstevenlin.com/how-to-choose-the-right-vitamin-k2-supplement/>  
(<https://www.drstevenlin.com/how-to-choose-the-right-vitamin-k2-supplement/>)

Reply



**Dave Kuhn** says: October 28, 2018 at 2:37 pm (<https://www.drstevenlin.com/vitamin-k2-deficiency-effects/#comment-2229>)

Dr. Lin,

Can supplementing with K2 improve teeth & jaw structure in adults?

Reply

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**Dr Steven Lin**  
(<https://www.drstevenlin.com>)

October 29, 2018 at 10:46 pm (<https://www.drstevenlin.com/vitamin-k2-deficiency-effects/#comment-2230>)

says:

Hi Dave, likely you need mechanical stimulation and myofunctional therapy via an orthopedic device & soft tissue retraining.

Reply

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**Alex** says: December 5, 2018 at 3:41 am (<https://www.drstevenlin.com/vitamin-k2-deficiency-effects/#comment-2231>)

Dr. Lin,

I would like to start off by saying thank you for taking the time to share this information. It's very nice to learn more about the importance Vitamin K2. I have a big question to ask you.

I believe around age 10 is the age I started mouth breathing. I'm 26 now and I was able to find a great doctor that actually cared about solving my underlying issue. I got my tonsils out...and now I can finally breathe nasally without any problems.

For all these years I had anxiety, stress, circles under my eyes, difficulty concentrating, low testosterone, low libido and it was from all from sleep apnea and mouth breathing.

I'm 26 years of age and after doing research...I'm realizing that my jaw/cheekbones may not have grown to their full potential because of my tonsils and how they made me mouth breathe.

My question is...without surgery, is there a chance I will still be able to grow/improve my jaw/mouth to my genetic potential if I take this Vitamin K2 with D3 and Calcium...as well as continuing to nasally breathe during the day and at night? I'm also now positioning my tongue to the roof of my mouth now.

I mean, my teeth are generally straight...some crowding on the bottom front row teeth and I had 4 wisdom teeth extractions...but is there still hope for me to grow my jaw bones more?

Many thanks in advance...

Reply

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**Pepper** says:

December 21, 2018 at 5:57 pm (<https://www.drstevenlin.com/vitamin-k2-deficiency-effects/#comment-2232>)

Hi, is it possible for K2 to help widen the jaw of an 18 year old? What age does the jaw stop growing completely?

Reply

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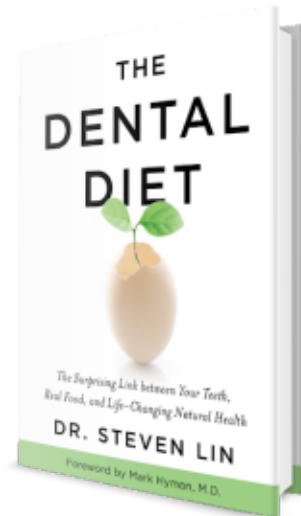
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