The Need for Vitamin D
by Dave Siever

Introduction

The winter of 2005/2006 was a real challenge for me. For no apparent reason, I had developed severe restlessness and insomnia by December. By January, I began feeling mildly depressed and was often "fuzzy-headed" and lethargic. I was waking up at 2, 3 and 4 am, and because of that, I would sleep in until 9:30 to 10 am the next day to try and make up for the lack of sleep. I was craving chocolate like mad – and simple carbs (candy, cake, etc.) as well - but mostly chocolate. By February, I was feeling like a tired, old man. I had no physical energy and felt very weak. I quit working out on the weights because it took just too much effort. By April, my lower right molar and gums began getting quite painful when I ate, making it difficult to chew. Later in April my upper left molar also began aching as well. Also, my elbows, knees and ankles began to ache. I was feeling really old, if not ancient. This was of great concern for me, as I normally feel physically strong.

In early April, just before attending the AAPB conference, I went for an 8-minute tan and noticed that later on in the day, I felt relatively good, but by the next day I was back in the slumps. A few days later, I went back and tanned to the point of getting mildly pink. The next day there was no change but the following three days I felt better. In particular I had an excellent head-space, even though my joints and mouth continued to hurt.

Suspecting a connection, I took time off from work every day at noon for the first two weeks in May, to take in at least 30 minutes of tanning in the warm, spring sun. Never have I got so much sun so early in the year and fortunately, this spring was the warmest and sunniest ever, with leaves sprouting and flowers blooming a full three weeks ahead of schedule.

By May 15th, my mind was sharp and all of my body pain had vanished. I was suddenly bursting with energy and strength and biked 25 miles on Mothers' Day! Best of all, my wit and humor returned and I enjoyed being the life of the party again. On May 20th, I went to Jasper National Park and participated in the annual SCUBA diving competition – feeling GREAT!

Winter 2006

This winter was unusual. We normally have a good foot of snow by Christmas, but this year, we didn't get snow until March 15! What this has meant to me and some of my clients whom I have since spoken to since, was that this was a particularly severe year for certain people suffering from symptoms of a pseudo seasonal affective disorder (SAD),

A possible reason for this may be due to a lack of reflection off of the snow. Edmonton is situated about 300 miles north of the USA/Canada border at 53 north latitude. Edmonton is a fairly sunny place and in Edmonton the sun shines at roughly a 20-degree angle

around the winter solstice. This means that plenty of sunlight bounces off of the snow and given that most clothes pass 10-20% of the sunlight, everyone would get some sunlight exposure. This year however, without the snow, I missed my weekend cross-country skiing and the concurrent nourishment from the sun.

The Vitamin D Story

Vitamin D is a potent steroid, much like testosterone. It is essential for the metabolizing of calcium (which is also essential for generating the voltage potentials in neurons). This explains the emotional collapse and the subsequent depression, anxiety, restlessness, insomnia and so on in those who are deficient. Vitamin D also plays a key role in muscle strength and the integrity of connective tissue and the maintenance of bones as well as playing a part in controlling swelling and in tissue repair. Vitamin D supplementation has been shown to reduce the risk of breast, colon, pancreatic and prostate cancer. Current research indicates vitamin D deficiency is a causal factor in 17 varieties of cancer, heart disease, stroke, hypertension, autoimmune diseases, diabetes, depression, chronic pain, osteoarthritis, osteoporosis, muscle weakness, muscle wasting, birth defects, periodontal disease, rickets, and the common flu.

Vitamin D is involved in brain function. Nuclear receptors for vitamin D are localized in neurons and glial cells. Genes encoding the enzymes involved in the metabolism of vitamin D are also expressed in brain cells. Vitamin D is important in neurotransmitter synthesis. Vitamin D has been shown to have neuroprotective and immunomodulatory effects and may help us resist bacterial and viral infections. A study of arterial and venous blood samples from 101 healthy Australian men over a one-year period found strong correlations between ambient sunlight and production of serotonin in the brain. In fact, depression and schizophrenia are highly correlated with vitamin D deficiency. Autism is also effected by seasonality, which may be related to vitamin D deficiency during pregnancy.

It has been thought that the average human utilizes roughly 1500 to2000 IU of vitamin D per day. However, recent research suggests that healthy men require upwards from 3000 to 5000 IU per day. Those who live above or below 30 degrees latitude are likely to become vitamin D deficient throughout the winter. Over one billion people worldwide have become deficient in vitamin D including many Americans who work all day in office buildings. It is estimated that somewhere between 21 to 58% of adults and adolescents in the US are vitamin D deficient (and this is based on the old, lower standard).

Vitamin D has been shown to significantly enhance the genetic expression of antimicrobial peptides in macrophages, thus improving up-front ability to attack and destroy a broad spectrum of invasive microbes, spanning both viruses and bacteria. This may be why there is a seasonal effect with flu. Flu season occurs in the winter of both the northern and southern hemispheres, and it is not attributed to more people staying indoors as previously thought.

The best kind of vitamin D is vitamin D3 (cholecalciferol) which comes from the sun. Most vitamin supplements also contain vitamin D3. Calcidiol (25-hydroxy vitamin D) is

a prehormone in your blood that is directly made from cholecalciferol. When being tested for vitamin D deficiency, calcidiol is the only blood test that should be drawn. When doctors refer to vitamin D blood levels, they are referring to calcidiol levels, but the lab will know calcidiol as 25-hydroxy vitamin D. The only natural sources of vitamin D are sunshine and fatty fish such as salmon and mackerel. Milk is fortified with vitamin D, but at very low levels – only enough to prevent rickets.

About SAD

Each year, 6% of northern populations are affected with Seasonal Affective Disorder (SAD) and another 14% have a milder form of SAD, called the *winter blues*. Surprisingly, SAD may occur at any time of year and even in equatorial regions although the ratio of northerners with SAD compared to those living in the tropics is about 10:1. People in the southern USA experience SAD in the summer from staying indoors where air conditioning allows them to escape the unbearable summer heat. People have also experienced SAD moving into a basement suite or an office on the north side of a building or after painting the interior of their home a darker shade of color. People have experienced SAD following the development of cataracts or after wearing sunglasses for an extended period of time and during overcast, rainy periods (Rosenthal, 1993).

The common symptoms are depression, anxiety, extreme fatigue, hypersomnia, carbohydrate cravings, and weight gain. Women between the ages of 20 to 40 (their sexually reproductive years) are most susceptible (Rosenthal, 1993). The first controlled study using light therapy to treat SAD was published in 1984. SAD was officially accepted as a clinical malady in 1987 by the American Psychiatric Association and described in its then current diagnostic manual, the DSM-III-R. Since that time, a great number of studies on the topic have been completed.

The "Captain and Pineal"

All species studied to date have been observed to have a biological clock. This clock is essential for survival by regulating various types and levels of arousal to provide cues for alertness, eating, sleeping and the release of hormones. Light waves striking the retina activate electrical output that is sent down the optic nerve to the brain for visual processing. A secondary, smaller nerve tract from the retina, originating from specialized cells that utilize a light detecting pigment called melanopsin, also carries signals to the suprachiasmic nucleus (SCN) of the hypothalamus. The SCN, in turn, sends nervous outputs to various parts of the brain including the pineal gland. Four genes that govern circadian cycles in flies, mice and humans have been discovered to not only reside within the SCN, but in all cells of the body. When cultured in a petri dish under constant lighting, these cells continue with gene activity, hormone secretion and energy production in a 24-hour cycle that varies less than 1% (Wright, 2002).

In the mid 70s, Dr. Alfred Lewy of the National Institute of Mental Health (NIMH) discovered the neurotransmitter melatonin. The wake/sleep cycle in animals and humans is controlled by melatonin, which is produced by the pineal gland, a structure the size of a pea and located in the mid-brain. Every night, the pineal gland excretes melatonin into the bloodstream and continues to do so until dawn. However, under normal exposure to

sunlight, secretions of melatonin follow the earth's light/dark time frame and therefore more melatonin is typically released during the long dark hours of the winter months. Henceforth, the pineal gland is in charge or "captains" our wake/sleep arousal states.

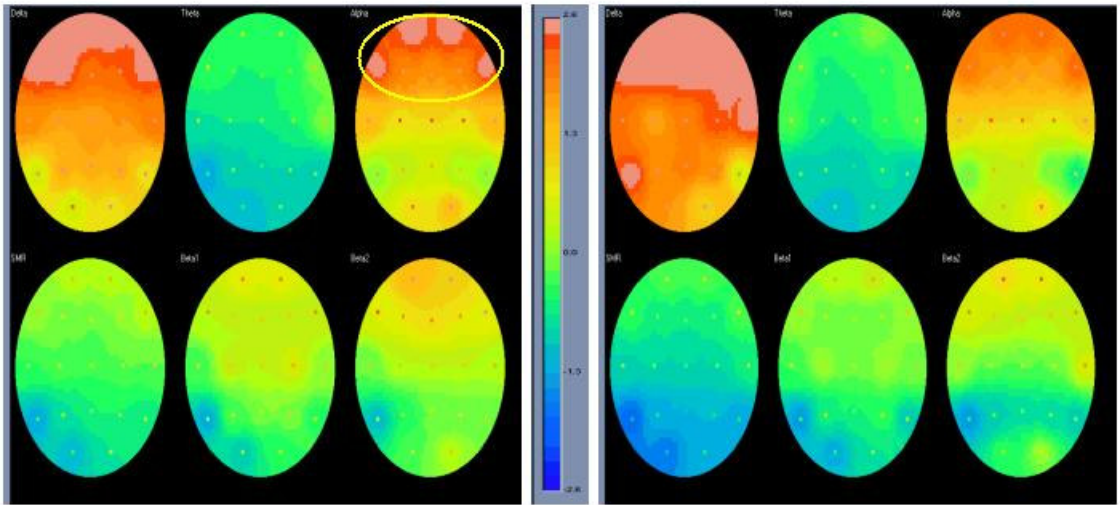
A Comparison Between SAD and Vitamin D Deficiency

Although most anxiety and depression inventories could be used to detect SAD, one popular SAD test is the *Seasonal Pattern Assessment Questionnaire* or SPAQ, developed by Rosenthal and his colleagues at the NIMH. The SPAQ is a self-assessment questionnaire that evaluates one's level of SAD. However, one big problem with the SAD test is that there is much overlap between the symptoms of SAD and vitamin D deficiency, and more than just the basic SAD type questions must be asked.

Symptoms of SAD	**Symptoms of Vitamin D Deficiency**
anxiety	anxiety & restlessness
depression	depression
fatigue	fatigue
carbohydrate cravings	carbohydrate cravings
hypersomnia	insomnia
	physical weakness
	connective tissue swelling

The literature on the brain wave effects of SAD is inconsistent, ranging from increased broad alpha/theta to increased left frontal alpha activity as seen in depression. Figure 1 shows an eyes-closed brain map from the Skil database at a scale of +-2.6 SD before and after two weeks of sun tanning. Notice the exceptionally high alpha (circled in yellow) when deficient in vitamin D. The high delta is primarily artifact. If this was a case of true SAD, it would have resolved itself by the time the post QEEG was taken on May 15, as eye/pineal exposure is significant by May.

Figure 1. Vitamin D Deficiency vs Sunlight Exposure



Treatment of SAD

A number of techniques are used to reduce the symptoms of SAD. These include long walks outside, aerobic exercise, a diet rich in complex carbohydrates and protein, relocating to sunnier locations, winter vacations to tropical areas, and frequenting sun-tanning centres. Light-based clinical interventions include light box therapy and audio-visual entrainment.

Light box therapy has been successful in reducing the SAD symptoms for 60% to 80% of users. White light therapy, using intensities of 2,500 lux, requires exposure times from 2 to 6 hours, a considerable time investment for the user. Light exposures with an intensity of 10,000 lux for 30-minutes has been found to be more effective than 2,500 lux intensity with exposure times of several hours. Some people have reported that overuse of light therapy can leave them feeling "wired" and restless.

Audio-Visual Entrainment (AVE), which uses flashing lights and pulsing tones, has been shown to enhance EEG activity at the stimulation frequency. However, a lesser-known attribute of AVE lies in its inhibition effect at roughly the half-frequency of stimulation. In the QEEGs that we have collected from SAD clients, we have observed long spindles of 10 Hz alpha brain wave activity, globally, with particularly increased activity in the left frontal regions. We conducted an AVE study with 74 people struggling with SAD. AVE at 20 Hz produced profound reductions in anxiety, depression, carbohydrate cravings and body weight. Energy and quality of life increased.

Treatment of Vitamin D Deficiency

The only treatment for vitamin D deficiency is by increasing vitamin D3, whether from food sources or via the sun. Many supplements are available. Studies have shown that it is difficult to become toxic from vitamin D and a wide variance of a suggested toxic limit exists in the literature. An adult may have to consume 4000 to 8000 IU for more than four months in order to become toxic.

Resources

For more information on vitamin D:

www.vitamindcouncil.com

Dale Kiefer. Why is Flu Risk So Much Higher in the Winter? Life Extension, February, 2007, 23-28.

For more information on SAD and treatment with AVE:

www.mindalive.com/1_0/articles%204.pdf

About the Author: Dave Siever graduated in 1978 as an engineering technologist. He later worked in the Faculty of Dentistry at the University of Alberta designing TMJ Dysfunction related diagnostic equipment and research facilities where he organized research projects, taught basic physiology and the advanced TMJ diagnostics course. Dave had noted anxiety issues in many patients suffering with TMJ dysfunction, prompting him to study biofeedback, which he applied to their patients and later design biofeedback devices.

In 1984, Dave designed his first audio-visual entrainment (AVE) device – the "Digital Audio-Visual Integration Device," or DAVID1. Since this time, through his company, Mind Alive Inc., Dave has been researching and refining AVE technology, specifically for use in relaxation and treating anxiety, depression, PMS, ADD, FMS, SAD, pain, cognitive decline and insomnia. He presents regularly at conferences and for special interest groups. Dave also designs Cranio-Electro Stimulation (CES) and biofeedback devices and continues to conduct research and design new products relating to personal growth and development.