

Hypothyroidism and Thyroid Hormone Supplementation

What is the thyroid gland and what does it do?

The thyroid gland is a large butterfly shaped gland located in the front of the neck. The gland produces thyroid hormone, which regulates the rate of metabolic processes in the body. If the thyroid is not working properly, it can affect every part of the body. The two most common diseases of the thyroid gland are **hypothyroidism**, in which the thyroid produces too little thyroid hormone, and **hyperthyroidism**, in which the thyroid produces too much. Here we will focus on the more common problem of hypothyroidism, and its treatment.

What are the symptoms of hypothyroidism?

Common symptoms are fatigue, sluggishness, memory loss or problems focusing mentally, depression, pain and swelling of joints, muscle aches or stiffness, weight gain, dry skin, brittle nails, hair loss, feeling cold, weakness, constipation, and hoarse voice. Women with low thyroid can experience heavy and/or irregular menstrual bleeding. Even borderline low levels of thyroid hormone can lead to symptoms and health problems.

What health problems are associated with hypothyroidism?

Low thyroid levels can cause elevated triglycerides and LDL cholesterol, the “bad” cholesterol that can lead to heart disease. Even mild hypothyroidism can lead to heart problems (high blood pressure, coronary artery disease, or heart failure). Low thyroid can also lead to depression, slowed mental functioning, infertility, and goiter (enlarged thyroid gland). Babies born to women with untreated thyroid disease have a higher risk of birth defects and are prone to significant intellectual and developmental problems.

What causes hypothyroidism?

It is natural for the thyroid to produce lower levels of thyroid hormone with aging, but this does not always lead to symptoms or a diagnosis of hypothyroidism. A common cause of thyroid dysfunction is an autoimmune disease known as Hashimoto’s Disease. It occurs when the immune system produces antibodies that attack thyroid cells, damaging the gland’s ability to produce normal amounts of thyroid hormone. Some other causes of low thyroid are radiation treatment to the neck, viral infection, or use of the psychiatric drug lithium.

There is a growing awareness that thyroid dysfunction may be linked to toxic chemicals, known as *thyroid disruptors*. Environmental pollutants such as pesticides, plastics, and perchlorates have been implicated as possible causes of thyroid dysfunction. Also, fluoride, a common additive to drinking water, may interfere with normal thyroid function. The actual impact of any of these thyroid disruptor chemicals on the health of individuals is unknown, and is the subject of considerable controversy. In clinical practice, there are cases where we simply cannot determine exactly what caused an individual’s thyroid gland to malfunction, but we can treat it, nonetheless.

The chemical element iodine is essential for thyroid health. The thyroid hormone molecule is composed of an amino acid tyrosine, plus three or four iodine molecules. Iodine is naturally found in seafood, sea salt, seaweed, and smaller amounts in cow’s milk, eggs, and some vegetables. In some parts of the world iodine

deficiency is a common cause of hypothyroidism, but in the US iodine has been added as a supplement to table salt, virtually eliminating iodine deficiency in the US population. However, in recent years, as health-conscious people avoid table salt, iodine deficiency may be on the rise. Of note, if a body is not actually iodine *deficient*, taking iodine supplements can cause or accelerate thyroid dysfunction. It is not a good idea to use an iodine supplement if thyroid disease is suspected or has been diagnosed. If thyroid disease is not actually caused by iodine deficiency (quite rare in the US), adding iodine can make matters worse.

How is hypothyroidism diagnosed?

First, let's take a look at how the body produces and regulates thyroid hormone, and this will help to explain how we diagnose the problem of decreased production. The thyroid gland produces two major thyroid hormones, T3 (triiodothyronine), and T4 (thyroxine). T3 is the active form of the hormone, used by cells of the body. T4 exists as a reserve supply that may be converted to T3 when needed. Thyroid hormone is regulated by thyroid stimulating hormone (TSH), produced by the pituitary gland at the base of the brain. If thyroid hormone levels are high (as in *hyperthyroidism*), pituitary production of TSH will *decrease*, signaling the thyroid to reduce production of thyroid hormone. If the thyroid is producing low levels of thyroid hormone (as in *hypothyroidism*), pituitary TSH production will *increase*, signaling the thyroid to increase thyroid hormone. If the diseased thyroid fails to respond by producing adequate amounts of thyroid hormone, TSH will remain elevated. Thus, hypothyroidism can be diagnosed when TSH levels are elevated.

Because serum TSH measurement is a sensitive test for detecting thyroid disease, it has become a commonly used screening test. A screening test, by definition, is one used to test for a disease when a person has *no symptoms* of the disease. If a person *has* symptoms, they should undergo a diagnostic test, a more thorough evaluation, in order to detect even the earliest signs of a disease process. For thyroid, this would involve testing not only TSH, but also testing levels of thyroid hormones T3 and T4, and sometimes also testing for thyroid antibodies to discover whether autoimmune disease is the cause. When testing serum levels, it is important to test for "free", or unbound levels of T4 and T3, to tell us how much active hormone is available for the body to utilize in performing its metabolic functions. A complete thyroid panel would check TSH, FreeT4, FreeT3, and thyroid antibody levels. This is recommended if a patient is having symptoms that could be attributed to low thyroid.

How is hypothyroidism treated?

If the thyroid produces too little thyroid hormone, oral supplementation is recommended. For some individuals suffering symptoms of low thyroid, we find T4 and T3 levels to be not quite *below* the normal laboratory range, but in the *low end* of the normal range. If an individual has symptoms that could be attributed to hypothyroidism, and is found to have these borderline low thyroid hormone levels, cautiously supplementing thyroid hormone may restore normal energy levels and alleviate other symptoms resulting from low thyroid. The goal is to move thyroid levels into the mid or upper portion of the normal range, while observing for symptom improvement.

There is disagreement in the medical community regarding the best way to treat and follow thyroid patients. Some doctors do not believe borderline thyroid disease should be treated at all, reserving treatment for only those with lab values well into the abnormal range, regardless of symptoms. Others maintain that patients may suffer not only unpleasant symptoms, but also adverse health consequences as a result of borderline low thyroid hormone levels. In my practice I have treated many borderline low thyroid patients using low dose thyroid replacement, and have observed improvement in symptoms and quality of life for these patients.

What are the options for thyroid hormone supplementation?

T4 (thyroxine): The most common treatment of hypothyroidism is a daily dose of thyroxine, T4. There are several brands: Synthroid, Levoxyl, Levothroid, Unithroid, and generic Levothyroxine to name a few. These are all the same T4 hormone replacement, produced by different manufacturers. They are produced

in a laboratory, and therefore are called “synthetic,” however, they are identical to the hormone produced by the thyroid gland. The thyroid gland produces mostly T4, which then is released into the circulation and carried to various organs, where it is converted by those tissues to T3, and then used for its ultimate metabolic purpose. Therefore, it makes sense to use T4 as thyroid supplement, and this is commonly recommended as first line therapy. Most patients do well with thyroxine, and find it improves or alleviates their symptoms. They experience more energy, less depression, and find it easier to lose weight. However, some individuals do not experience symptom relief using T4-only supplementation, despite hormone levels returning to the normal range. For these individuals we may consider other options.

Combinations of T4 and T3: Another choice for thyroid supplementation is porcine (pig-derived) thyroid hormone. Brand names include Armour Thyroid and NatureThroid. These are extracts of porcine thyroid gland, and contain a combination of T4 and T3, as well as minor thyroid hormones T1 and T2, and calcitonin in small amounts. Thyrolar is a synthetic version, containing the same T4/T3 ratio, without the minor hormones. The hormones of these medications are bio-identical, the same molecules as human thyroid hormones, but they are present in differing proportions in the pig, as compared to the human. Humans produce T4 to T3 ratio of 10-15:1, whereas pigs produce a 4:1 ratio of T4 to T3. Therefore, care must be used in determining the proper dose. Sometimes using a combination of thyroxine and porcine thyroid gives a more favorable ratio of T4 to T3. Some individuals find treatment with porcine thyroid relieves symptoms better than treatment with thyroxine alone. Those allergic to pork should not use Armour or NatureThroid, but may use Thyrolar.

T3 Therapy (Cytomel, Liothyronine): Yet another choice when replacing thyroid is to use T3 alone, or in addition to a T4 supplement. Liothyronine (generic) or Cytomel (brand name) are examples of T3-only thyroid supplements. A drawback of using T3 in this form is the short half-life, thus requiring 2-3 daily doses. Since food can impair absorption, this can be inconvenient, and can cause some difficulty in maintaining stable blood levels.

Laboratory follow-up for thyroid supplemented patients:

It is important for those using thyroid hormone supplementation to have regular testing of thyroid hormone levels. Dosage requirements may change over time. If thyroid hormone levels become elevated this can lead to heart palpitations, arrhythmias, and possibly decreased bone density. On the other hand, if levels drift down, symptoms of low thyroid may recur.

It's a common practice for doctors to follow only TSH levels in thyroid patients, and to adjust hormone supplement dosage so TSH remains in a certain range; this range varies with different labs and with different doctors. Some patients (not all) have optimal T3, T4 levels and feel their best *only* when TSH is suppressed to very low levels, even below the normal lab report range. Some doctors may look at that suppressed TSH and conclude that the patient is over-supplemented. Here we find some disagreement within the medical community.

Others practice a treatment philosophy that says we should observe what happens clinically, and treat the patient, not just the lab report. If a patient is clinically improved on a given thyroid dosage, has no signs of thyroid excess, and has T3/T4 levels in the normal range, then showing suppression of TSH simply means the pituitary is no longer stimulating the thyroid, because the individual is receiving thyroid hormone as a supplement. There is no need for the pituitary to secrete TSH, so it is suppressed. There is no inherent danger in suppression of TSH. Its function is to stimulate thyroid hormone production, and if one's thyroid isn't doing a good job, we are not going to depend on TSH to stimulate it any longer. Instead, we are going to use thyroid supplementation.

For those patients who do require TSH suppression in order to feel their best, close follow up is recommended, due to the potential of adverse sequelae if thyroid hormones should begin to reach abnormally high levels. I recommend that all TSH-suppressed patients undergo physical examination (measurement of blood pressure and heart rate, and cardiac examination) as well as laboratory testing of

TSH, FreeT3, and FreeT4 levels every 4-6 months. In addition, bone density testing will be recommended at appropriate intervals, individualized for each patient.

What are possible risks of treatment?

Considerable controversy exists on this subject. Some studies suggest that chronic suppression of TSH through thyroid hormone replacement can lead to osteoporosis, but this has not been a consistent finding. There are large studies that show no increase in osteoporosis, even with lifelong total suppression of TSH (required in treatment of thyroid cancer). Bone density screening is recommended for those of increased risk (such as post-menopausal women), or those who have TSH suppression. Another concern: for elderly people or those at increased risk for cardiac disease, thyroid levels in the upper-normal range have been shown to increase risk of cardiac arrhythmias, which can lead to stroke. Caution must be used in treating elderly patients or those with cardiac disease.

IMPORTANT: Instructions on taking thyroid meds:

It is best take thyroid hormone in the morning on an empty stomach, and do not eat for at least 30 minutes afterward, as food interferes with absorption. You may take your pill at night if you prefer, but be sure it has been at least 2 hours since any food, and do not eat afterwards for at least 30 minutes. Calcium interferes with absorption, so do not drink milk or calcium fortified orange juice or soymilk, and do not take a calcium supplement with your thyroid tablet. Iron and magnesium also interfere. If you take supplemental calcium, iron, or magnesium, or use any antacids (Tums, Rolaids, Mylanta) wait at least 3 hours before taking thyroid medication.

What are possible side effects of treatment?

Side effects could occur due to individual medication sensitivity, or due to intolerance of thyroid supplementation. In either case, one could experience shakiness, nervousness, heart racing or palpitations, diarrhea, headache, or sleep disturbance. Some have reported hair loss with thyroid replacement. Remember, hair loss can also be a sign of low thyroid, so is sometimes a pre-existing condition. If side effects occur, an alternative supplement formulation may be explored.

How long will I need to take thyroid supplementation?

Thyroid supplementation is usually a lifelong necessity. Dosage requirements may vary with changes in metabolic needs or other hormonal changes. It is common to require an increased dose during pregnancy, so thyroid levels should be tested periodically in pregnancy. With oral estrogen replacement, it may be necessary to increase the dose of thyroid hormone, however this is not the case with transdermal estrogen therapy. If you begin using an iodine supplement, this may change your thyroid replacement needs. Anyone using thyroid supplementation should have blood levels measured at least once per year, more frequently for some.