
A PHYSICIAN'S GUIDE TO: HYPOSALIVATION, DRY MOUTH, AND XEROSTOMIA

There are so many things we take for granted until they're gone, and saliva is one of them. Saliva has an effect on the entire GI system and the respiratory system. Therefore, it has a significant impact on the entire body that belies its seemingly minor role in the mouth. Dry mouth might seem like a minor

Introduction

WHY SALIVA?

- Begins **digestion**. The enzyme Amylase in saliva begins the process of breaking down carbohydrates from food in the mouth. It also contains Lingual Lipase, Kallikrein and
- **Lubricates** the tongue and lips for smooth
- **Protects** the lining of the mouth from damage caused by abrasive foods and objects.
- Assists with acidity levels in the digestive tract. Bicarbonate ions **regulate** the pH levels in the mouth (think of decay) and esophagus (think of GERD).
- Acts as a solvent so that substances in the mouth can be **tasted**.
- Maintains a **clean** and hygienic mouth and carries anti-bacterial agents. (immunoglobulins). They destroy microorganisms and remove toxic substances (think gum disease). Think MICROBIOME!
- Contains Opiorphin, a pain-killing substance that is up to six times more potent than morphine.
- Haptocorrin, a protein, binds to vitamin B12 to protect it against degradation in the stomach before it binds to intrinsic factor.
- Promotes healthy teeth by encouraging remineralization and discouraging demineralization.

Did you know? Our salivary glands can produce between 1-2 liters of saliva daily.

How Is Saliva Produced?

Eating: Food intake stimulates a variety of sensory receptors: gustatory receptors, mechanoreceptors, nociceptors and olfactory receptors. All four modes of taste elicit secretion via the "gustatory salivary reflex," but the sour taste is the most effective stimulus, followed by salt. That is why sucking on sour (lemon) candies is such an effective sialagogue.

Chewing also makes the teeth move, stimulating mechanoreceptors in the periodontal ligaments. This is referred to as the “masticatory salivary reflex.”

We can use chewing activity to increase salivation. Chewing gum is very effective at stimulating salivation. We also find that excessive muscle contractions, as occurs with Parkinson’s disease, can actually cause hypersalivation, something that can be controlled with the judicious use of Botox.

Sucking: Breast-feeding is an important, saliva-encouraging activity. When a baby is given a bottle that does not encourage active sucking, the result could be decreased salivation and associated GI and respiratory issues later in life. A child whose entire nutrition is based on “sippy cups” will not only suffer from hyposalivation, but also not get important oro-facial



Fig. 1. Main functions of saliva in relation to its constituents

Diagram: Van Nieuw Amerongen, A., Bolscher, J. G., & Veerman, E. C. (2004). Salivary proteins: protective and diagnostic value in cariology? *Caries Res*, 38(3), 247-253. Page 4, figure 1.

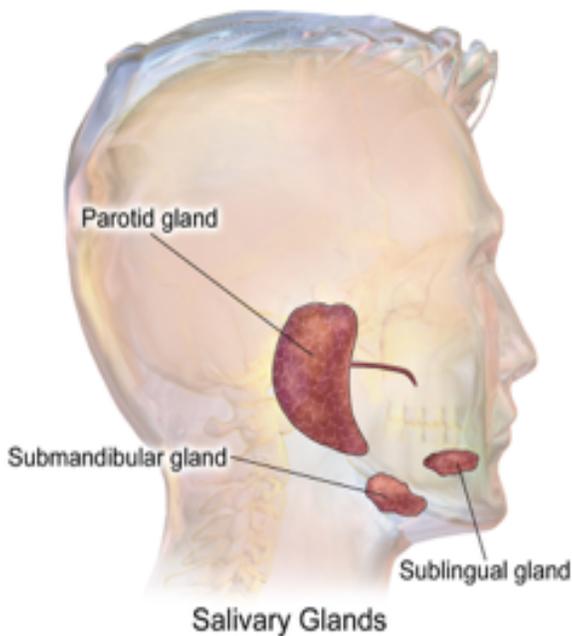


Photo: Blausen.com staff. "Blausen gallery 2014". *Wikiversity Journal of Medicine*. DOI:10.15347/wjm/2014.010. ISSN 20018762.

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- Dental Caries
 - Gum Disease (Periodontitis)
 - Oral Candidiasis
 - Dysgeusia (altered taste, including metallic taste)
 - Dysosmia (altered smell)
 - Sialadenitis (infection of the salivary glands)
 - Halitosis (bad breath)
 - Oral Dysesthesia (burning or tingling)
 - Dysphagia (difficulty swallowing and chewing)
 - Hoarseness
 - Increased risk of respiratory infection



Image: Facebook (You Have Dry Tongue)

Hyposalivation can be a reversible drug-induced side effect. Hyposalivation is commonly found in elderly people who have numerous drugs prescribed to them on a long-term continuous basis – particularly in psychiatric patients. It remains an often-neglected clinical problem, but it is being more widely recognized by the public, as there are more media advertisements for dry mouth symptom remedies.

It should be noted that a person might have hyposalivation and not necessarily complain of a dry mouth. Salivary flow tests are difficult to do and they are rarely done in dental offices. Besides, the well-known antimuscarinics, antihistaminics, imipraminic antidepressants and phenothiazic neuroleptics many drugs may induce hyposalivation or altered salivation.

We're just beginning to understand the interaction that the microbiome has with our health. We do know that saliva plays an integral role in maintaining a healthy microbiome in the oral cavity, which has a domino effect on the rest of the contiguous GI tract. When salivary flow or quality changes, the healthy organisms diminish in favor of potentially pathogenic ones.

For instance, we know that decay is caused by Strep Mutans and Lactobacillus species. But there are many Strep species in the mouth, which compete with one another. For instance, Strep Salivarius and Strep Sanguinis must be displaced in order for Strep Mutans to exist in large enough numbers to cause decay. Researchers are looking at measuring the ratio of these organisms to assess risk for dental caries. Similar research is being done for periodontal disease.

We know, for instance, that a child's microbiome is affected by their parents' microbiomes. Strep Mutans is passed from parents to their newborn children, along with other microbes, both good and bad. So a disease that was once thought of as a "genetic predisposition" might actually be a communicable one.

We also know that children delivered vaginally have a significantly higher incidence of certain strains of health-related streptococci and lactobacilli than babies delivered via C-section. It has been shown that the microbiome actually begins developing in-utero, with oral microbes from the mother finding their way into the placenta. This is one reason that oral care during pregnancy is so important.

It's this understanding of the role of the microbiome that promises to yield the greatest advance in oral disease prevention. Perhaps using a probiotic inoculum or mouthwash will be the answer to preventing oral and other diseases. In the meantime, controlling the oral environment, and maintaining normal salivary flow and oral hygiene are important factors in maintaining health.

So can you catch tooth decay and gum disease? The answer is YES. And this is true especially if the oral environment does not have a healthy salivary function.

Also, someone whose oral ecology has changed over time, as happens with dry mouth, has an increased risk not just to himself or herself but to others they might infect.

It's a 2-way street. People with dry mouth are more prone to decay and gum disease and hence are more likely to infect others.

Why does it matter?

The oral microbiome doesn't just affect the mouth. There is considerable evidence that the change in the oral microbiome affects other systems as well. A pathogenic oral microbiome can be aspirated, resulting in respiratory infections. Perhaps, xerostomia in elderly people is another factor increasing their risk of developing pneumonia?

We also know that GERD is affected by changes in the microbiome. Just how that change is impacted by oral salivary changes is not yet understood. But as the upper GI system is contiguous with the oral cavity, one can assume that there is a relationship.

Our saliva promotes certain bacteria and minimizes others. In particular, it promotes 'good' bacteria and inhibits "undesirable" bacteria. Bacteria that use nitrate (NO₃) instead of oxygen produce nitrite as a metabolic byproduct. When nitrite combines with acids it acts as a poison that destroys "good" bacteria and might encourage a vigorous host response that results in periodontal (gum) disease. Sanchez, Miozza et al showed that salivary nitrate and nitrite levels were elevated in people with periodontal disease.

Saliva also contains proteins (mucins) that serve as a matrix that attracts bacteria. This allows them to attach before being swallowed, where they are then destroyed in a properly functioning and highly acidic stomach. In the event anti-acids are used, bacteria normally killed might survive and wreak havoc further down the GI tract. This is yet another example of the complex interactions that occur within the body.

Another issue that is particularly important for the elderly population has to do with eating and nutrition. Dry mouth affects eating in several ways. Lack of lubrication makes the process less efficient and more uncomfortable for the person. In the extreme cases, it can even make swallowing difficult (Dysphagia). Plus, a lack of saliva can result in the inability to taste and smell, as saliva is necessary to solubilize foods and yield these sensations. When foods don't taste or smell good, a person is less likely to eat them. A person's lack of hunger might in fact stem from their inability to taste and/or smell their food.

Dry mouths can be problematic for people who wear artificial oral prostheses. The lack of lubrication can irritate mucous membranes and make the

CAUSES OF DRY

- Drugs
- Smoking (iatrogenic)
- Irradiation
- Chemotherapy
- Graft vs host disease
- Alzheimer's disease
- Diabetes
- Parkinson's disease
- Salivary gland disease or obstruction
- Salivary aplasia (agenesis)
- Sjogren's syndrome
- Sarcoidosis
- Stroke
- Cystic fibrosis
- Primary biliary

Perhaps the most prevalent cause of xerostomia is medication. Xerogenic drugs can be found in 42 drug categories and 56 subcategories. More than 400 commonly used drugs can cause xerostomia. - See more at: <http://www.oralcancerfoundation.org/complications/xerostomia.php#sthash.hE5RmqFN.dpuf>

prostheses uncomfortable to wear. The inability to wear them can impact chewing function. The ability to properly process foods by both salivary breakdown and proper chewing is essential to maintaining GI health and overall nutrition. The mouth is the primary entry point for food and it is also vital for respiration. Both are needed to maintain life, and so the health of the mouth is of critical importance.

Of the Top 25 Most
Commonly Prescribed
Meds in 2013, 20 are
Associated with Dry
Mouth!

- √1. Hydrocodone and acetaminophen (Vicodin)
- √2. Simvastatin (Zocor)
- √3. Lisinopril (Prinivil, Zestril)
- √4. Omeprazole (Prilosec)
- √5. Amlodipine (Norvasc)
- √6. Levothyroxine (Synthroid)
- √7. Atorvastatin (Lipitor)
8. Azithromycin (Zithromax)
- √9. Furosemide (Lasix)
10. Ciprofloxacin (Cipro)
- √11. Prednisone
- √12. Metformin (Glucophage)
13. Amoxicillin
- √14. Metoprolol (Lopressor)
15. Tramadol (Pain)
- √16. Hydrochlorothiazide (Blood Pressure)
- √17. Gabapentin (Neurontin)

DRUG CATEGORIES ASSOCIATED

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- Anticholinergic drugs
 - Tricyclic antidepressants
 - Muscarinic receptor antagonists for treatment of overactive bladder
 - Alpha receptor antagonists for treatment of urinary retention
 - Antipsychotics such as phenothiazines
 - Diuretics
 - Antihistamines
 - Sympathomimetic drugs
 - Antihypertensive agents
 - Antidepressants (serotonin agonists, or noradrenaline and/or serotonin re-uptake blockers)
 - Appetite suppressants
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Strategies for dealing with dry mouth:

As always, looking for the cause is the first step. If the cause can be removed, then the symptom might be, too. Below are strategies one can use to deal with dry mouth:

Using a humidifier at night can help.

Chewing sugarless gum or sucking on sugarless hard candy during the day can also help stimulate salivary flow. I prefer candies that include Xylitol, as it has been shown to reduce bacterial aggregation, a factor in the pathogenesis of decay and gum disease. I'm not a huge fan of gum chewing, but it has shown to be an effective way to stimulate saliva.

I would avoid recommending gum chewing to patients who are taking SSRI's, since they might already be predisposed to muscle or TMJ issues.

Drinking water and maintaining adequate hydration is always a good idea. Having water available by the bedside for nightly sipping is helpful.

Enabling nasal rather than mouth breathing is crucial. Our nasal passages are meant to hydrate the air we breathe, so not being able to do so is a problem, for which the cause should be examined. Nasal strips that open nasal passages can encourage nasal breathing.

Smoking and drinking alcohol can cause dry mouth and should be limited or totally avoided.

There is a product called XyliMelts®, which contains an adhesive patch which, when placed in the cheek or gum area, stimulates saliva, even at night. This product is also mint-free, something that is important, since some people who have dry

There are many “natural,” “homeopathic” and “herbal” remedies. None of them have been studied in controlled settings. The following is a list of such

- Cayenne pepper
 - Coconut oil
 - Colostrum
 - Fennel seeds/ Anise seeds
 - Cardamom
 - Raw sauerkraut
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One should not underestimate the dangers that a dry mouth poses to teeth. Decay can wreak havoc in an otherwise healthy mouth. Even “filled” or restored teeth can succumb to decay. In fact, any artificial material interface with a tooth is **more likely** to get decayed than a natural tooth. Plus, root decay is more likely when there’s a decrease in quality or quantity of saliva.

Decay is of concern not only because it can result in tooth loss, but also because it can result in infection when decay enters the pulp of the tooth. Such infections have a systemic effect on the entire immune system and can be of great concern to people with underlying compromised immune systems, impaired kidney function or cardiac disease.

Alcohol, caffeine and smoking all cause dry mouth and should be avoided to minimize the extra drying effects. Even mouthwashes may contain alcohol, and they should also be avoided. There are mouth rinses available that do not contain alcohol.

Fluoride is one of the few things we know about that strengthens tooth material and hence, slows down tooth decay. Note I said “slow down” and not “prevent.” Nothing we know of today can truly prevent decay. At this time, all we can do is slow its progression. Fluoride can be used in many applications, the most effective being a professionally applied varnish. It is best applied after a prophylaxis is performed. At home rinses and prescription-strength pastes such as Prevident might be prescribed.

Fluoride is only effective as a remineralization aid when it comes into contact with tooth structure. So cleaning the teeth prior to fluoride use is essential. Professional applications are the most effective. Fluoride toothpastes also work because they are used while the teeth are being cleaned. Mouth rinses used are only effective when used after tooth brushing.

We use a system called Carifree to measure the activity of the bacteria that cause decay (Strep Mutans, Lactobacilli). This is only one part of a risk assessment. Once a person is determined to be “at risk” for decay, a system of toothpastes and mouth rinses can be prescribed to the person to deal with the specific risk factors, diminished saliva being one.

People at risk for dry mouth and hence, increased decay and gum disease, are urged to see their dentist more regularly. We now also do a simple saliva test to assess the presence and levels of specific periodontal pathogens. These pathogens also have been shown to have a link to many systemic illnesses such as Cardiac Disease, Stroke, Alzheimer’s Disease, Diabetes and Cancers. For people at high risk, we recommend a 3-month schedule of preventative visits. This will allow for a thorough evaluation to detect problems that might not be apparent. Instituting specific, customized programs in the office and at home allows a better level of control and prevention.

Cavities and even gum disease might not be apparent. Patients might not hurt or feel sensitive. Everyone’s personal early warning system functions differently, and some people have none. The first sign they see of a problem is an abscessed, painful tooth. Any bleeding however is an early warning sign that should be dealt with a degree of urgency. If in doubt...ask us.



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