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with **Perio Reports** by Trisha E. O'Hehir, RDH, MS

Salivary Testing in the Office

The Value of Saliva Testing

by Trisha E. O'Hehir, RDH, MS
Hygienetown Editorial Director

We know that saliva is incredible, edible spit and that it is becoming the diagnostic fluid of choice for the medical profession. Saliva testing is easy to do and non-invasive. The human salivary proteome was recently published identifying more than 1,000 proteins. Many research groups are investigating ways to test saliva in a credit-card-sized nanosensor to identify a variety of cancers and other diseases. Before we move ahead to widespread saliva testing for medical reasons, let's take advantage of the many ways we have to measure and analyze the beneficial aspects of saliva as they relate to oral health and disease. The flow rate, viscosity, buffering action and pH of saliva provide a wealth of information that enhances treatment planning to prevent dental disease.

Xerostomia is on the rise. More people are taking more medications, all with dry-mouth side effects. Simple chairside tests make it easy for clinicians to determine the quantity and quality of saliva objectively. The tests are simple and easy to do – they just take time. The time invested in gathering information about saliva will be valuable for both patient and clinician as you tackle the risks associated with caries and periodontal disease. A few things can be incorporated into an already-busy dental hygiene visit, but to gather all the necessary facts, schedule a separate visit of 30 minutes to do the tests. Medicine routinely schedules appointments for lab tests. Why not do the same for dental disease? Create a saliva testing appointment, especially for those with active caries or those concerned about bad breath. The information gathered provides the answers you need to address the problems. Tim Ives and Dave Bridges, both RDHs from the U.K. provide the step-by-step process to make your new saliva testing appointment a success. ■

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Parafunctional Habits Linked to TMD in Teens

Temporomandibular dysfunction or TMD is characterized by three symptoms: pain, joint noises and difficulty opening the mouth. Parafunctional habits are linked to TMD. These include nail biting, clenching, grinding, lip or object biting and gum chewing.

Researchers at two universities in Sao Paulo, Brazil, surveyed 244 adolescents enrolled in elementary and high school in the city of Sao Roque in the state of Sao Paulo, Brazil, regarding harmful habits and TMD signs and symptoms. The children ranged in age from 10 to 20 years. All the questions on the survey were yes/no design. Children were asked about parafunctional habits (listed above) and signs and symptoms of TMD: headache, joint noise, difficulty or pain upon chewing, tired feeling in the face, "locked" jaw,

facial pain and difficulty opening the mouth. The screening questionnaire was developed by the American Academy of Orofacial Pain. Identification of three or more signs of TMD indicates need for a definitive diagnosis of TMD.

Headache was the most common symptom, reported by 41 percent. Noise in the joint was reported by 25 percent and 14 percent reported difficulty talking or chewing. Facial fatigue was reported by 10 percent, and nine percent reported experiencing "locked" jaw.

At least one harmful oral habit was reported by 16 percent, two by 20 percent, three by 39 percent and no oral habits by 25 percent. There was a significant correlation between the number of harmful oral habits and the number of TMD symptoms.

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Clinical Implications: Evaluate teens for parafunctional habits as they are linked to TMD. ■

Motta, L., Guedes, C., DeSantis, T., Fernandes, K., Mesquita-Ferrari, R., Bussadori, S.: Association Between Parafunctional Habits and Signs and Symptoms of Temporomandibular Dysfunction Among Adolescents. Oral Health Prev Dent 11:3-7, 2013.

Does Light Enhance Whitening?

Researchers report conflicting results when comparing tooth whitening with and without the use of an intensifying light. Some show that the light helps to whiten teeth while others show it has no effect.

Researchers in the division of dental hygiene at Ohio State University in Columbus, Ohio, compared whitening with and without the use of the Zoom light from Discus Dental, a division of Philips. The study included 49 patients whose teeth were whitened using a 25 percent hydrogen peroxide gel, Discus Zoom 2.

For each patient, the gingiva was isolated using a light-cured resin dam, Discus Liquidam. The whitening gel was placed on the maxillary and mandibular anterior teeth at a thickness of

2mm. The gel was placed on the right or left half (depending on random assignment) and the sodium arc light positioned directly in front of the mouth for 15 minutes. The gel was then removed with high volume evacuation and new gel was applied. This process was repeated for three 15-minute whitening sessions. The opposite sides of the arches were then treated with three 15-minute whitening sessions without the light. Patients were seen at one week and two weeks to take the shade and get their feedback on whitening and sensitivity.

At one week, the maxillary teeth whitened using the light were found to be a lighter shade. At two weeks, there was no difference. Patients saw no difference at any time. Very little sensitivity was reported.

Clinical Implications: When whitening with 25 percent hydrogen peroxide the light will only produce a lighter tooth shade for one week. ■

Henry, R., Bauchmoyer, S., Moore, W., Rashid, R.: The Effect of Light on Tooth Whitening: A Split-Mouth Design. Int J Dent Hygiene 11:151-154, 2013.

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Vitamin D Found Beneficial for Periodontal Health

Although gingivitis and periodontitis are both caused by the toxic waste products of oral bacteria, the immune system plays a significant role in the health or breakdown of the connective tissue and bone. A good diet and in some cases, dietary supplements can enhance the immune system. Vitamin D might be helpful in controlling the inflammation associated with gingivitis and periodontitis. The upper limit recommended by the U.S. Food and Nutrition Board is 2,000IU. Researchers suggest this limit could be safely raised by 10 times.

Researchers at the Dental College in Dharwad Karnataka, India tested three vitamin D dosages in a group of 88 patients in a randomized, placebo controlled trial. The three-month study included four groups, each receiving a dietary supplement. Three groups received vitamin D in various dosages: 2,000IU, 1,000IU and 500IU. The fourth group was given a placebo. At 30-day intervals, all the subjects were seen for a blood draw to determine vitamin D levels and a gingival index.

As anticipated there was no change in the blood level of vitamin D in the placebo group. Blood levels of vitamin D in the three test groups were elevated corresponding to the supplement dosage. The higher vitamin D dose revealed a correspondingly higher blood serum level.

The gingival index also revealed a dose-dependent change, with the higher dose leading to greater reduction sooner compared to the lower doses.

Clinical Implications: Vitamin D is a safe and effective anti-inflammatory supplement when given in a dose of 2,000IU per day. ■

Hiremath, V., Rao, C., Naik, V., Prasad, K.: Anti-Inflammatory Effect of Vitamin D on Gingivitis: A Dose-Response Randomized Control Trial. *Oral Health Prev Dent* 11:61-69, 2013.

Curcumin Spice Mouthrinse Reduces Gingival Inflammation

The gold standard mouthrinse for treating gingivitis is chlorhexidine. The side effects of staining and taste alteration make compliance with product use difficult. Patients today are asking for natural products rather than synthetic chemicals. Curcumin is derived from the root of a spice with anti-inflammatory, antioxidant, antimicrobial and antibacterial properties that can be used in a mouthrinse. Curcumin is one of the substances in the spice turmeric and gives it the yellow color.

Researchers at Rangoonwala Dental College in Puna, India, compared a mouthrinse made with curcumin to a 0.2 percent chlorhexidine mouthrinse in patients with gingivitis. Three groups of 10 patients each received scaling and root planing at baseline. The control group received no mouthrinse. One test group was given chlorhexidine 0.2 percent and the other test group was given a 20 percent curcumin mouthrinse. Both rinse groups were instructed to rinse twice daily for one minute and to do the rinsing 10 minutes after brushing.

At days seven, 14 and 21, subjects were examined and plaque and gingival indices were recorded. On day seven, all three groups showed significant improvement in the gingival index. On days 14 and 21, the two rinse groups had lower scores than the control group. Plaque scores reduced to the same degree for all three groups. The curcumin mouthrinse may be a natural alternative to chlorhexidine. Longer-term studies are needed to confirm this finding.



Clinical Implications: It would be interesting to find that a spice – curcumin (turmeric) – may possess the anti-inflammatory properties capable of controlling gingivitis. ■

Muglikar, S., Patil, K., Shivswami, S., Hegde, R.: Efficacy of Curcumin in the Treatment of Chronic Gingivitis: A Pilot Study. *Oral Health Prev Dent* 11:81-89-6, 2013.

One Session of Motivational Interviewing Not Enough

Motivational interviewing is a “collaborative, person-centered form of guiding to elicit and strengthen motivation for change.” Motivational interviewing engages people by asking them how healthy they want to be and what they are willing to do for oral hygiene and periodontal maintenance. Traditional oral health education is typically a lecture with instructions. Motivational interviewing originated in the addiction field and is now being used to achieve behavior change related to obesity, physical fitness, mental health, glycemic control and smoking cessation.

Researchers at University of Missouri in Kansas City, Missouri, compared traditional oral health education alone to traditional oral health education plus a short 15-minute motivational interviewing session in a group of 53 periodontal maintenance patients. These patients had bleeding on probing scores of 40

percent or at least two interproximal sites with probing scores of 5mm or more.

Patients underwent a regular periodontal maintenance visit with oral hygiene education. All subjects completed four questionnaires evaluating knowledge and motivation. One week later, half the group returned for the individualized motivational interview session provided by an experienced non-dental counselor. Clinical indices and questionnaires were repeated at six and 12 weeks.

No differences were observed between the groups for clinical indices or the knowledge and motivation questionnaires. Perhaps if the motivational interviewing had been part of the oral health education it might have had an impact on motivation.

Clinical Implications: A separate motivational interviewing session provided no added benefit over traditional oral health education in a group of periodontal maintenance patients being seen in a university clinic. ■

Brand, V., Bray, K., MacNeill, S., Catley, D., Williams, K.: Impact of Single-Session Motivational Interviewing on Clinical Outcomes Following Periodontal Maintenance Therapy. Int J Dent Hygiene 11: 134-141, 2013.

Prevention Education Varies Between Dentists and Hygienists

Dental education is focused on repairing the damage of dental disease with little emphasis on prevention compared to the education of dental hygienists which focuses primarily on prevention of dental disease. In the United Kingdom, the National Health Service has focused on treatment rather than prevention or quality in the past. Revised contracts between the government and dentists will likely change the reward system to focus on prevention and quality as well. Education of dentists should include prevention.

Researchers at Cardiff University in Wales, U.K., used a questionnaire to compare attitudes toward prevention between dental undergraduates and hygienists and therapists. A 28-item questionnaire was sent to 121 fourth- and fifth-year dental students and 38 hygiene/therapy students. The return rate was 62 percent with a similar return rate for each group

In the U.K., the Department of Health provides a toolkit of prevention information it expects to be delivered to adults. The four essential aspects are brushing twice daily with fluoridated toothpaste, minimum of 1,350ppm fluoride in the toothpaste, brush last thing at night and one other time and spit out after brushing but don't rinse.

All the hygiene/therapy students found their education adequately covered prevention, compared to 63 percent of dental students. Dental students placed less emphasis on oral health and would generally provide education only as needed or only at the first visit. Hygienists/therapists who are educated differently, reported they would provide oral hygiene education much more frequently.

Clinical Implications: Dentists should rely on dental hygienists to provide prevention education to their patients. ■

Morgan, M., Verkroost, S., Hunter, L.: Evidence-Based Prevention: A Comparison of Oral Hygiene Advice Given by Dental and Dental Care Professional Students. Int J Dent Hygiene 11:121-125, 2013.

Salivary Testing Office

in the

by Timothy Ives, RDH, BSc (Hons), FHEA
and Dave Bridges, RDH, BS

Building on the CE course published in the March 2013 issue of *Dentaltown Magazine* on xerostomia, it's now time to apply that information to clinical practice. Testing saliva can be just a few observations during a regular dental hygiene visit or several steps that require a separate appointment. Patients found to be at risk of caries are good candidates for a saliva testing visit. Gathering data about the pH, flow rates and buffering capacity of saliva will provide valuable baseline information and the evidence to support your recommended interventions to prevent further caries.

Reduced salivary flow or hyposalivation can be measured clinically. The subjective feeling of a dry mouth is referred to as xerostomia. Reduced saliva flow can cause a problem in a number of ways. Firstly, patients will not produce enough saliva during eating to be able to easily chew their food, form a bolus and swallow. From a caries perspective, they don't produce enough saliva to dilute and wash away dietary acid or acid formed as a result of bacterial metabolism of sugars. They also have, in effect, a buffering problem. There are insufficient minerals being excreted to neutralize acid. This means that any acid in the mouth is present for much longer than would otherwise be the case, increasing the risk of net mineral loss from

the teeth. If the mouth is maintained at a lower pH, acidogenic bacteria implicated in caries will thrive in these low pH conditions. The biofilm selects for the environment in which it develops. The lower the pH, the more acid-producing bacteria will be found in the biofilm. The higher the pH, the fewer acid-producing bacteria will be found.

Side effects of medication and dehydration both impact saliva levels. Saliva production drops when a person is dehydrated. The average person should consume approximately two liters of water a day. This amount needs to be increased for people with physical occupations, those participating in sports activities and active children. Dehydration has a domino effect on the dilution and buffering effects of saliva, major contributors to the homeostasis of the oral environment.

Chairside Testing

Xerostomia

Salivary testing in the office begins with a visual assessment of xerostomia. The Challacombe Scale was developed based on research conducted at King's College London Dental Institute, under the supervision of Professor Stephen Challacombe. Its purpose is to visually identify and quantify xerostomia.

The Challacombe Scale works as an additive score of one to 10, with 1 being the least severe xerostomia and 10 being the most severe xerostomia. Each of the 10 aspects observed scores one point, providing a total score. Symptoms of xerostomia will not necessarily progress in the order listed, but summated scores indicate likely patient needs. Any cumulative score higher than three is likely to be a high-risk patient.

1. Mirror sticks to buccal mucosa
2. Mirror sticks to tongue
3. Saliva frothy
4. No saliva pooling in the floor of the mouth
5. Tongue shows generalised shortened papillae
6. Altered gingival architecture (i.e.: smooth)
7. Glassy appearance of oral mucosa especially palate
8. Tongue lobulated/fissured
9. Cervical cavitations on more than two teeth
10. Debris on palate or sticking to teeth

If the Challacombe score indicates xerostomia, it's time to begin chairside saliva testing. Easy tests can be done for viscosity, pH, resting and stimulated flow rates and buffering capacity.

Viscosity

The viscosity of saliva is related to the proportion of proteins, such as mucin, to water and can be assessed by simply looking underneath the tongue. Saliva is 99 percent water and should be clear, like water, not thick, stringy, frothy or bubbly. It is thought that thicker saliva results in poor pellicle coverage leaving the enamel naked to the various acidic challenges in the mouth. The quality of the saliva usually relates to the resting flow rate and it can be altered by systemic diseases, medications

and radiation therapy, which affect the flow and/or salivary protein compositions. The viscosity of saliva may also be related to overall hydration levels however, for others, it may just be a physiological feature to note.

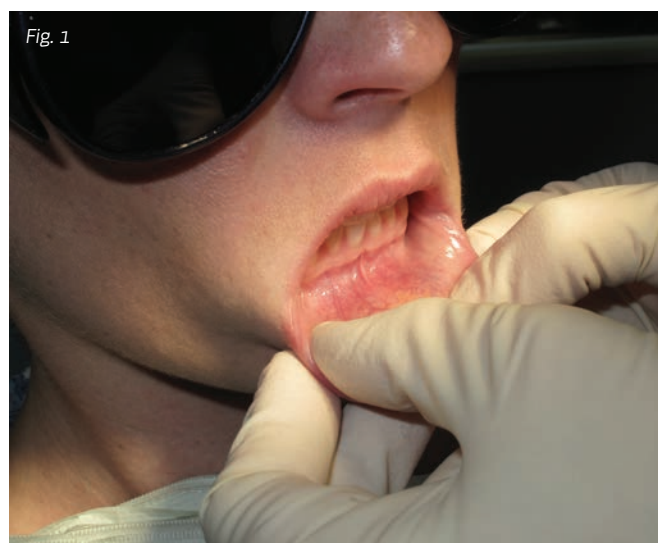
The viscosity can be viewed simply by looking under the tongue. If the clinician is unsure, then massage the salivary duct underneath the tongue, which will activate this area and ensure that a good picture can be obtained. Assign the standing saliva to one of three categories: thick/stringy, frothy/bubbly or thin/watery.

Resting Flow Rate

The majority of the resting saliva comes from the sub-mandibular glands. This saliva is much lower than stimulated saliva (which comes mostly from the parotid glands) in minerals, proteins and enzymes and is naturally more acidic. The pH of this saliva can also be affected by physiological changes such as hormonal issues, medications and diseases. A low pH for resting saliva will have a negative effect on the acid value of the biofilm pH, as this will be encouraging the right conditions for the development of acidogenic bacterial strains. This should also affect the remineralization protocol recommended by the clinician.

The lower lip is dried using a piece of gauze or tissue paper and a timed observation is carried out until small beads of saliva start to appear. If saliva appears in small beads in less than 30 seconds, this indicates the patient is sufficiently hydrated and has a healthy resting flow rate.

More than 30 seconds for beads of saliva to appear indicates moderate flow rate. If it takes more than 60 seconds for the saliva to appear, the flow rate is significantly reduced. Greater than 30 seconds indicates dehydration and/or a xerostomia issue, higher than a minute demonstrates a very low flow rate. A discussion with the patient regarding fluid consumption is recommended, which is considered in conjunction with the medical history. If the patient isn't drinking enough fluid this needs to be managed and the appropriate advice given to increase fluid intake.



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Resting pH

To gather resting saliva, the patient is asked to refrain from swallowing for 30 seconds and then instructed to expectorate all saliva into a cup. The sample is tested with universal indicator paper, allowed to dry for one minute and the pH assessed against a universal indicator color scale.

This example demonstrates an acidic resting pH. Patients with a low resting pH need as much help as possible. A good education in the implications of this to the patient is very important and neutralization of the acidity as regularly as possible is key. This can be achieved through alkaline foods such as cheese and nut snacks, baking soda toothpastes and rinses. The introduction of neutralizing gum and mints especially those containing xylitol are effective. A fluoride rinse as an adjunct at mid-day would be recommended preceded by a neutralizing product.



Stimulated Flow Rate

Low stimulated flow rate may be due to a number of factors, from dehydration to medication side effects and radiation treatment of the head and neck. Other causes include physiological problems with the saliva glands' excretory systems or the ducts that carry saliva into the mouth. Sixty-eight percent of xerostomia is caused by medication side effects.

In order for patients to notice that they have a dry mouth, the flow rate has usually dropped by 50 percent. Patients may typically report taking a drink to bed with them at night, waking up with a dry mouth or reporting difficulty in chewing, swallowing and speaking.

The stimulated saliva test serves a dual purpose. It enables the production of saliva stimulated by the act of chewing to be measured. It also provides a sample of saliva that can have its buffering efficacy tested. In this test, the patient is given a piece

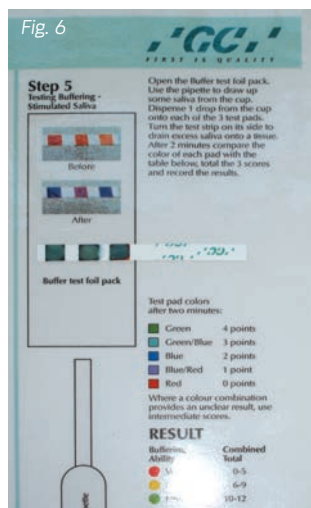
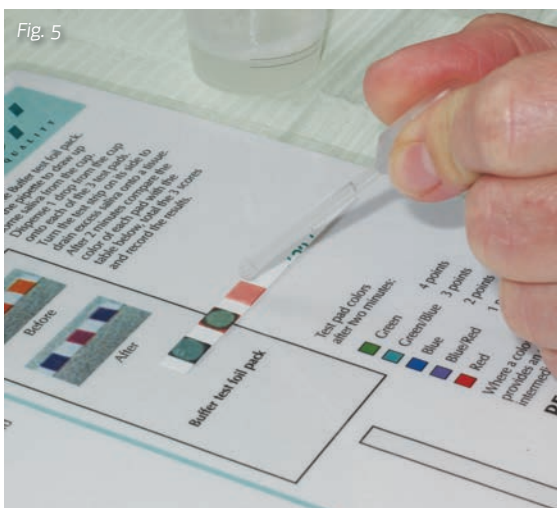
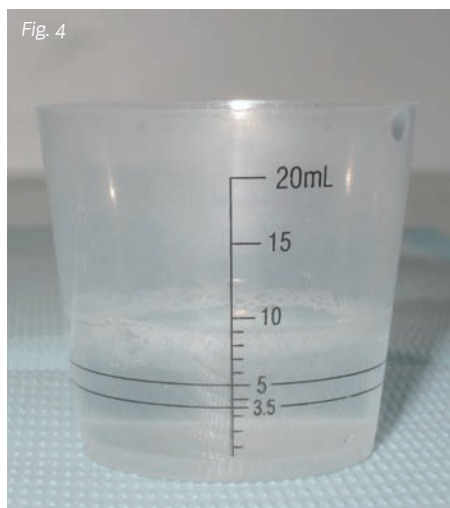
of unflavored paraffin wax to chew. This is of a similar nature to chewing gum.

The patient chews normally and expectorates any saliva produced into a measuring cup for five minutes. The amount produced in that time is measured. A normal production rate is around 1ml per minute. Some patients have a higher flow rate than this!

Buffering

Buffering is the ability to resist a change in pH. However stimulated saliva from the parotid glands does not buffer in the true sense – acid is neutralized by bicarbonate in saliva – though the term is commonly used. It also provides calcium and phosphate, which are essential for the remineralization of the tooth. The buffering test measures for all these minerals.

The patient's buffering capacity is a physiological factor that cannot be changed by clinical intervention, although there is good evidence to support this might change throughout life and can be affected by such factors as medication, disease and physiological changes such as pregnancy, where there is a reduced calcium level in saliva. The buffering capacity of stimulated saliva is related to mineral content. Stimulated saliva normally con-



tains higher levels of bicarbonate. This may be lacking in patients who have low buffering. Low saliva flow also affects overall mineral availability.

The buffering capacity is measured by taking some of the stimulated saliva from the previous test into a pipette. A drop of saliva is placed on each of the three pads on the test strip taking care to cover the whole pad. One drop of stimulated saliva is placed on each square using the pipette.

The strip is then tipped on its side and gently tapped to shake off the excess saliva. The strip is then left for two minutes. After this time, the pads are assessed for color change and scored according to the guide. All three scores are added together to give a buffering index.

Conclusion

Saliva testing provides you with objective measurements to confirm what you often observe clinically in patients with xerostomia. You can incorporate some of these objective tests into your current dental hygiene visit or provide all of them in a separate appointment for patients at risk of dental caries. The more information you have, the better your plan will be to cure caries for your patients. ■

Author Bios

Tim Ives, BSc (Hons) RDH, FHEA, spent 22 years in the Royal Air Force, much of that time providing dental hygiene services. His tours of duty included Hong Kong, Cyprus, Germany, New Zealand, Holland and the UK. Tim is a founding member of O'Hehir University, an online institution providing a degree completion program for dental hygienists. He has a passion for minimally invasive dentistry (MID) and co-runs an MID based web site with his friend, colleague and co-author, Dave Bridges: - www.dentalvillage.co.uk.



Dave Bridges, RDH, BSc, served for nine years in the Royal Air Force, originally working as an Aircraft Engineer. After five years, an injury forced retraining in dental assisting and hygiene skills. In 1987 he qualified as a dental hygienist as has worked as a clinician since then. Dave considers himself a hopeless gadget fan and technophile which explains his role in the MID Web site - www.dentalvillage.co.uk - developed with his friend, colleague and co-author Tim Ives.



The authors of this article are also the co-authors of the upcoming book *Curing Caries*.

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