STEPWISE

saliva testing

GOOD PRACTICE, GOOD SENSE!

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exclusive

Saliva is nature's miracle in the mouth: saliva plays a vital role in dental health as patients strive to maintain a healthy dentition throughout their lives.

Saliva is the primary growth environment for flora of the oral cavity. As the physico-chemical properties of the saliva are changed, this affects what microorganisms will grow in the mouth. In terms of mineral loss, if the environment of the mouth is acidic, then mineral loss is likely to occur; however, if the environment has an alkaline pH, then the gain of mineral is equally possible, and in this context it is important to recognise that saliva is the major reservoir from which this mineral comes.

What happens when saliva stops protecting the teeth is exactly the opposite. In the mouth which has a consistently low salivary pH at rest, it is not unusual to see recurrent caries, accelerated tooth wear, dental erosion, and Candida albicans infection. Salivary testing provides baseline information that helps the clinician determine the ability of the saliva to protect the teeth from mineral loss. Follow-tests can then be used for monitoring.

In those patients who display accelerated tooth wear, there is strong evidence for a critical role of saliva, particularly of the resting salivary pH. There are several reasons for a link between salivary dysfunction and tooth wear:

- reduced clearance of dietary acids,
- reduced pH of the saliva, thus favouring the net loss of mineral from the teeth,
- reduced buffer capacity, preventing both dietary and also endogenous acids from being neutralised,
- reduced remineralisation of surfaces, and
- softening of tooth structure leading to accelerated wear from normal wear and tear under occlusal and incisive forces, and labial wear from toothbrushing.

A saliva test is an excellent way of being able to identify that these patients suffer from this particular problem, and it provides the framework around which their management is based. Repeat saliva testing can show when the lifestyle factors which drive the problem have been corrected. Once this point has been reached, the dentist can then go on to restore the teeth with some

confidence that the physical properties of the tooth structure are optimal.

STEPS IN SALIVA TESTING

This section presents a step-by-step walk through the saliva testing process. A saliva testing procedure normally consists of a series of steps, which are described in more detail in the following paragraphs:

1. the rate of production of resting saliva as a surrogate measure of hydration,
2. the viscosity of resting saliva as a surrogate for measuring its relative water and mucin content,
3. the pH of resting saliva,
4. the rate of production of stimulated saliva,
5. the pH of the stimulated saliva, and
6. the buffer capacity of the stimulated saliva.

The first part of the procedure is to have the patient sitting up and relaxed, and to gently grasp hold of the lower lip and to blot it gently with a gauze square. The time taken to form droplets of saliva on the minor glands of the lower lip can then be timed. Individual droplets will appear, leaving a glistening surface. The maximum time required for this period of observation is 60 seconds. Minor salivary gland ducts which are not producing any saliva at the end of this 60-second period are easy to observe.

The patient should then expectorate all resting saliva from their mouth into a small disposable cup. The second stage is to assess the viscosity of this saliva which can be determined by visual examination, that is, is it watery, bubbly, or frothy and sticky? This is sometimes more easily seen by placing the cup against a dark background.

The third step is testing the pH of the sample of resting saliva in the cup. This is done by dipping pH test paper directly into the sample of oral fluid to wet it, and then removing it immediately. It is important not to let the paper dry before scoring it as this can affect the visual interpretation of the colour. The individual pH value should be recorded in the patient notes. The collection cup is then rinsed with water and shaken dry, so that it can be re-used in the following step.

In the commonly used Saliva-Check Buffer Test Kit (GC Corporation), the pH paper has been designed specifically to function like a series of traffic lights, going from red through to yellow through to green. The colour can be matched directly to the scale provided, and a red, yellow or green overall result obtained.

The fourth step is to test the quantity of the stimulated saliva in order to screen for the possibility of salivary gland disease, particularly gland damage from lymphocytic sialoadenitis which can occur with a range of different medical conditions. To stimulate the production of saliva, an inert piece of paraffin wax is typically used. The paraffin is removed from its packaging and the patient then chews. All saliva produced in a timed period (eg. two or five minutes) is then drained into a cup. It is best that the patient be left to produce the sample of stimulated saliva in quiet and in privacy.

The volume measured is the liquid component, not any supervening frothy material, and this must be read at the base of the meniscus. From this value, one can then calculate the actual flow rate in ml/minute, which should be recorded into the patient notes and classified using the traffic light system into very low, low or normal. A normal individual should be able to produce 1 ml of saliva per minute when chewing.

The fifth step is to test the pH of the stimulated saliva using pH paper. Because of the higher concentration of bicarbonate ions in parotid saliva, this should be markedly higher than the pH value at rest. The striking colour difference of the pH paper between the resting and stimulated saliva will often attract the patient's interest, and provides a valuable starting point for discussions as to the protective roles of saliva.

The final stage of the test is the buffer capacity, which is assessed by challenging the stimulated saliva in an aqueous environment with differing amounts of lactic acid. A small pipette is used to withdraw a small quantity of saliva, which is then placed on test pads to give a colour result. Sufficient saliva must be placed in order to wet the pad fully. Any excess can be blotted away.

In the GC kit, if the applied saliva has a low buffer capacity, the test pads will remain bright red. If the saliva has a normal buffer capacity, each of the three pads will turn green. Intermediate results with a blue colour and partial transitions, are also possible. Each pad that scores green is given four points, a partial green/blue result three points, blue two points, blue/red partial transitions one point, and red pad zero points. In this way, a 12-point scale is created from which one can identify later changes in buffer capacity over time as part

of monitoring the progress of the patient. The allotted points are tallied. If the patient scores between 10 and 12, a combined total, this indicates that their buffer capacity is within the normal range. The remaining sample of stimulated saliva can also be used for other tests such as a solid phase immuno-assay for Streptococcus mutans levels.

CLINICAL APPLICATIONS OF SALIVA TESTING

One can use the Saliva Check Buffer Test Kit in a range of clinical situations. In patients who present with cervical dentinal hypersensitivity, one may see several areas where there is cervical tooth loss from dental erosion. In a patient who has accelerated tooth wear, the resting pH may be rather low, for instance near 5.4. If the stimulated pH was also low, for example 5.8, and the buffer capacity below normal, this indicates a more complex problem which affects the gland tissues such as organic salivary gland disease.

Where there is dramatic loss of tooth structure, this could occur from wear of softened tooth structure. The resting salivary pH may be low and near the critical threshold. If the stimulated pH was normal and the buffer capacity also normal, one would concentrate on occupation, recreation and medication in the first instance. Closer examination of the maxillary incisors would provide a clue as to the presence of reflux disease.

In a patient with incipient root surface caries, the resting flow rate may be low, and the resting pH may also be low (eg. at 5.6), while the stimulated pH could be nearer the normal range (at 6.8). In such a patient, low buffer capacity would suggest major salivary gland disease such as Sjogren's Syndrome, which is not uncommon in elderly female patients.

Similarly, patients with cervical lesions which encircle the teeth, a low flow rate, high viscosity and low resting pH (such as 5.8) would not be unexpected. If there was also a low buffer test result, this would imply damage to the functional capacity of the salivary glands.

Saliva testing helps to point the clinician in particular directions and away from others, and it provides a means to assess changes over time as various factors in the patient's lifestyle are altered. Understanding the salivary environment is critical to achieving long-term oral health for the patient. One can restore teeth, but those restorations are doomed to fail rapidly unless the salivary environment is corrected.

FOOTNOTE:

The text of this article has been adapted with permission from the manual *Saliva Testing: Good Practice, Good Sense* by LJ Walsh, published by GC Asia © 2002.

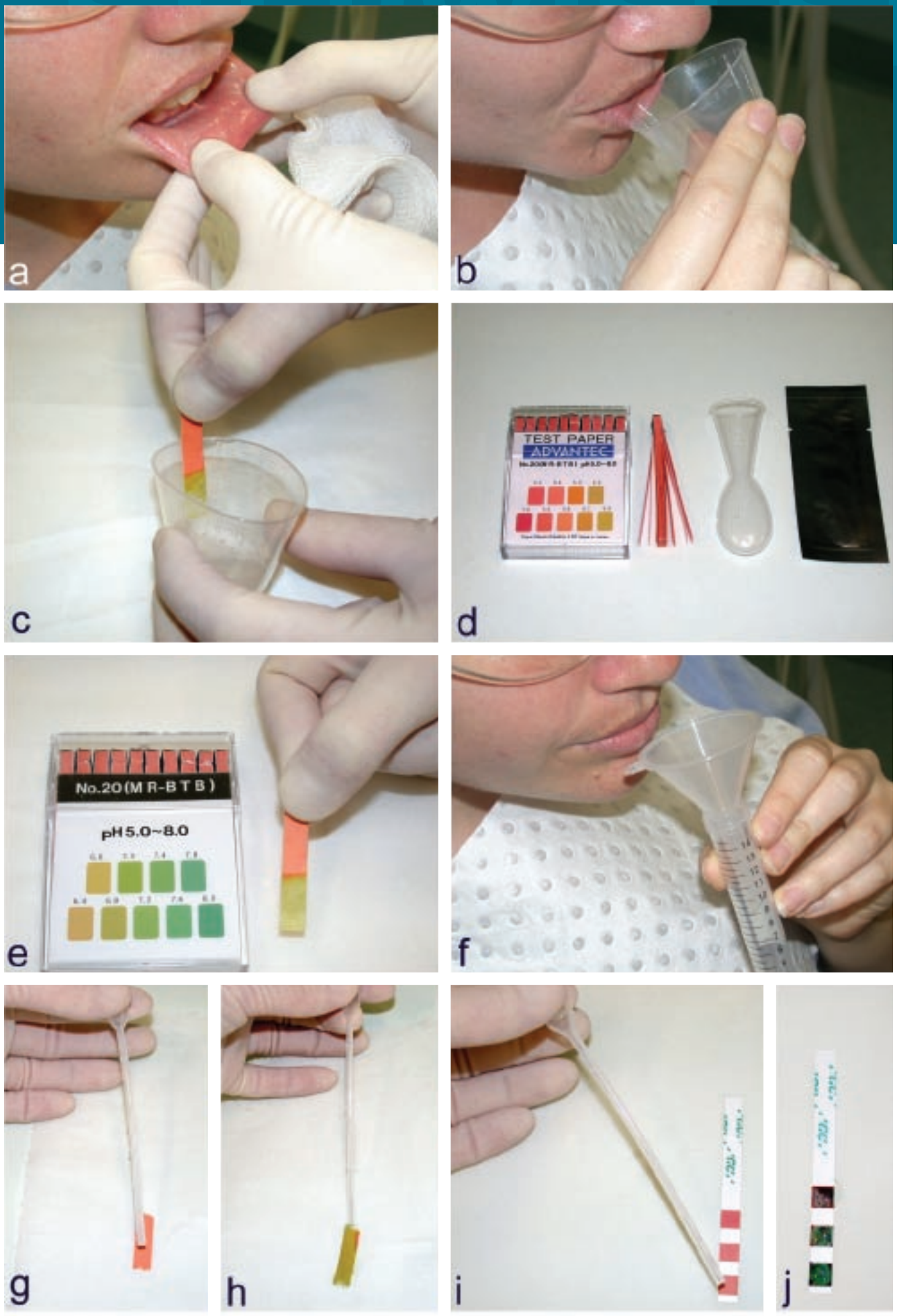

Fig 1. An overview of the saliva testing process. a) Assessing the resting flow rate using the droplet time. **b)** Collecting resting saliva. **c)** Testing the pH of resting saliva. **d)** Components used for testing pH and buffer capacity, comprising pH test paper, a collection vessel for saliva and buffer test strips (packed in foil). **e)** Measuring the pH of the resting saliva. **f)** Collecting stimulated saliva into a graduated container. **g)** and **h)** Applying stimulated saliva to pH test paper using a pipette. **i)** and **j)** Testing buffer capacity using test pads impregnated with acid.