

The Weak Spots of Saliva Buffering Tests

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ABSTRACT

Saliva buffering test is in need of improvements. This article illustrates the most commonly used saliva buffering capacity tests and its major problems. Starting with Ericsson and his laboratory buffer capacity test and all the way to Kitasako a lot of issues are to release. The aim of this paper is to put saliva buffering tests up to serious discussion.

Key words: saliva buffering test

Introduction

In the recent years prophylaxis treatment and preventive caries diagnostic are becoming more important in the dentist attendance. An appropriate preventive management needs an accurate assignation of the individual patient's caries risk, in order to avoid diseases of the teeth and the periodontal ligament. An easy and quick method for detecting caries risk is a simple saliva buffer capacity test. Saliva buffering capacity is a significant protective mechanism against food and plaque acids. Already Ericsson showed that a low saliva buffer capacity is related to a high caries risk. In 1959 Ericsson¹ developed a laboratory buffer capacity test, modifying it by adding hydrochloric acid and eliminating carbon dioxide by bubbling air through the saliva sample. The final pH is measured and ranked into three categories:

1. High buffering capacity (a low sliding of the pH)
2. Medium buffering capacity (a more significant sliding of the pH)
3. Low buffering capacity (a significant sliding of the pH)

Kitasako² clarified in his study the difficulty of this basic approach (Fig. 1). The figure shows the sliding of the pH according to the addition of HCl. The pH change occurs from person to person by a different HCl addition. According to this it is an approximate measurement of the buffering capacity.

There are three problems:

1. The definition of the HCl amount is arbitrary, although it's the foundation of the measurement.

2. This arbitrary boarder is all the more problematic, because it is set in the area of the steepest decline of the particular titrations curve. For this reason the estimation is sensitive on inevitable measurements errors.
3. The evaluation of the saliva buffering capacity based on the pH value, after adding HCl, is at the most a surrogate-mass for the actually buffering capacity. It is in theory well defined as a proton change system, but practically not really definable.

In spite of these problems the Ericsson test has become the gold standard for the measurement of saliva buffering capacity. In the literature the most commonly used tests are the Modified Ericsson test (quantitative standard test), the Colorimetric paper strip test, the Liquid colorimetric test and a quantitative test using a hand-held pH meter. The commercially available colorimetric test can be easily undertaken in the dental office, because it is simple to use and the result is ready almost immediately. For saliva sampling the patients have to chew a piece of unflavored paraffin wax for five minutes. Subsequently the saliva test sample is continuously collected into a vial. The colorimetric buffer strip has to be placed on a steady, absorbent surface and a drop of stimulated whole saliva has to be dispensed onto the test pad, using a pipette. After 2 to 5 minutes, according to the manufacturer, the color of the test pad is compared with the buffer color chart to obtain the buffering capacity. At the moment the most commonly used colorimetric tests are Saliva Check® (GC, Shenzhen, China) and CRT-

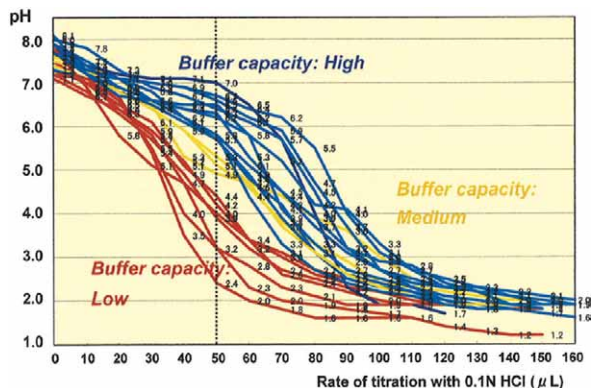


Fig. 1. Kitasako Y, Moritsuka M, Foxton RM, Ikeda M, Tagami J, Nomura S: Simplified and quantitative saliva buffer capacity test using a hand-held pH meter. *Am J Dent* 2005; 18: 147–150. The pH change of individual stimulated saliva after titration with 0.1N HCl.

-Buffer® (Ivoclar Vivadent, Schaan, Liechtenstein). Although the paper strip method is easy to use, the color matching with supplied color guides are often problematic (Figs. 2 and 3). Dentist’s color perception is subjective and can be affected by ambient lighting and operator’s experience³. For the Saliva Check® it is often difficult to distinguish the color of the sample, because there is a color variety on the paper. Furthermore the color reaction is dependent on the time of incubation⁴. Low buffer scores are drifting towards high scores with time. Also the viscosity of the saliva sample can influence the results, the more viscous the saliva, the less able it seems to wet the paper. In Kitasakos paper 25% of the saliva samples showed a high viscosity and recorded color codes that were difficult to classify⁵. For that the liquid colorimetric test is preferred for high viscous saliva samples. Moreover it has to be stated that there are problems with the standardization of the saliva sampling method, due to the fact, that stimulated saliva influences the outcome⁶. Resting saliva has a lower buffering capacity and when the colorimetric method is used all tests would supposable show a low buffer capacity. What’s more you have to differentiate between men and women’s saliva, due to a different saliva flow rate⁷. Practicing dentists are often skeptical in regards to saliva buffering capacity tests, due to a relatively high sales price and because of the necessity to calculate the expenditure of time, therefore the cost value ratio is put into question. A recent survey shows that amongst German Dentists 70.9% said, that they don’t use a caries risk test routinely in their dental office⁸. The majority stated that they don’t utilize



Fig. 2. Saliva check buffer: Problematic color matching.

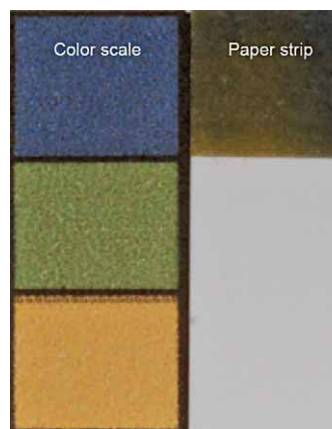


Fig. 3. CRT buffer: Problematic color matching.

caries risk tests, because the results don’t agree with the clinical outcome. This study showed again, that the entire area of saliva diagnostic is in need of strong improvements. At the moment no test available is so specific and sensitive that caries risk can be diagnosed from saliva samples only.

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NEDOSTACI TESTOVA ZA PUFERSKI KAPACITET SLINE

S A Ž E T A K

Test za puferski kapacitet sline zahtjeva poboljšanje. Ovaj članak daje pregled najčešće rabljenih testova za puferski kapacitet sline te njihove glavne nedostatke, počevši od Ericssonovih testova pa sve do Kitsakovih. Cilj je članka povesti ozbilju raspravu o testovima za puferski kapacitet sline.