Simplified method to estimate salivary buffer capacity

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Abstract — A new and simplified method to estimate the salivary buffer capacity was tested. The method, Dentobuff Strip, consists of a pH indicator paper that has been impregnated with acid. A small volume of saliva is added to the strip and after 5 min, the color of the strip is compared with a chart. The colors have been chosen to indicate low, medium, or good buffer capacity. The buffer capacity of stimulated saliva samples from 62 subjects was measured with the new method and compared with two commonly used clinical methods, Dentobuff, and an electrometric method. The three methods correlated well, and patients with a low salivary buffer capacity (final pH < 5.1) according to the electrometric method, were readily identified with the new Dentobuff Strip method.

Key words: saliva, buffer capacity.

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The salivary buffer capacity is an important factor to maintain a suitable pH in the oral cavity during the night. The buffer effect varies among individuals, and a low or extremely low buffer capacity has been reported to correlate with an increased dental caries experience (1).

A method for measuring the salivary buffer effect was developed by Erickson (1). According to this method, hydrochloric acid is mixed with saliva. After the elimination of carbon dioxide by bubbling air through the mixture, the final pH is measured electrometrically. In an attempt to make the method more practical, Bratthall & Hager (2) omitted elimination of carbon dioxide and found that patients with low salivary buffer capacity could be identified anyway. By exchanging the pH-meter for a liquid colorimetric pH-indicator (Dentobuff, Orion Diagnostica) (3, 4), chairside measurements of salivary buffer capacity were easy to perform.

To further simplify the Dentobuff method, a strip method has now been developed. A small amount of acid has been dried on a prepared pH-indicator strip. One drop of saliva placed on the test pad (Dentobuff Strip, Orion Diagnostica) will dissolve the acid and the final pH is read as a color.
Contingency table of comparison between Dentobuff Strip and electrometric method (1) and Dentobuff method (2).

<table>
<thead>
<tr>
<th></th>
<th>Dentobuff Strip</th>
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<th>Dentobuff (pH)</th>
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<tbody>
<tr>
<td></td>
<td>≤ 4.0</td>
<td>4.1–5.5</td>
<td>≥ 6.0</td>
</tr>
<tr>
<td>Low</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Intermediate</td>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>High</td>
<td>0</td>
<td>2</td>
<td>35</td>
</tr>
<tr>
<td>Contingency coefficient: 0.006 (max 0.816).</td>
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Change of the pH-indicator. The method identifies saliva with low, intermediate, and high buffer capacity.

Material and methods

Whole saliva was stimulated by chewing a piece of paraffin wax of about 0.9 g (Oxoid Diagnostica) and 3 ml were collected at room temperature from each of 50 patients and staff members at the School of Dentistry in Malmö, Sweden. The buffer capacity was immediately determined by three methods: 1) the electrometric clinical standard method developed by Enckner (1) modified to use 3 ml 0.005 M HCl to be mixed with 1 ml saliva; 2) the Dentobuff method (2, 4), and 3) the new Dentobuff Strip. To evaluate the reliability of the Strip method, all salivas were added to strips by two investigators, each one performing only one of the methods.

The Dentobuff strip kit contained pH indicator strips, disposable pipettes, and a color chart indicating low (final pH ≤ 4.0), intermediate (final pH 4.1–5.5), and high (final pH ≥ 6.0) saliva buffering capacity. The test strip was placed on a flat surface and one drop of saliva was pipetted on the test pad, using the enclosed pipette. After 5 min, the color of the test pad was compared with the color chart. If an uneven color reaction was seen on the test pad, the color representing the lowest buffer capacity was chosen.

Statistical evaluation was performed on

Fig. 1. Plotting of buffer values measured by electrometric method (1) against Dentobuff Strip intervals.
grouped data analyzed in contingency tables (Tables 1 and 2).

Results
The three methods showed a good correlation (contingency coefficient at least 0.731 (max. 0.816) for any two methods compared) when three buffering intervals were chosen according to the Demetoff Strip method (Fig. 1). Minor differences between the methods can be seen in Fig.-1, and in Tables 1 and 2. If the strips were left for more than the 5 min recommended by the manufacturer, the color indicated a higher final pH. All duplicates of the Demetoff Strip, except for one case, showed identical color reactions.

Discussion
The Demetoff Strip method was found to be a reliable method and simpler to use than previous methods for identifying subjects with low or very low buffer capacity. The color reaction was dependent on the time of introduction. Low buffer subjects were drifting toward high scores with time. As compared to a test tube, the surface area on the Strip was large in relation to the volume of saliva. The color drift might thus be an effect of continuous lost of carbon dioxide from the saliva + the Strip.

In evaluating the caries risk of a patient, a number of factors such as mutans streptococci, lactobacilli, sucrose intake, fluoride exposure, and plaque severity must all be considered. Salivary factors such as secretion rate and buffer capacity provide additional information to this evaluation. The more relevant factors that are included, the better the caries risk can be assessed (5). However, it seems that evaluation of all risk factors seldom is performed, because practical methods have been lacking. The Demetoff Strip method is such a practical method.

References