Effect of acidic food and drinks on surface hardness of enamel, dentine, and tooth-coloured filling materials

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Summary Objectives: The purpose of this study was to determine the effect of acidic food and drinks (Cola soft drink, drinking yogurt, orange juice, sports drink, Tom-yum soup) on surface hardness of various substrates (enamel, dentine, universal composite, microfilled composite, conventional glass ionomer, resin-modified glass ionomer, polyacid-modified resin composite).

Methods: Specimens ($n = 10$) were alternately immersed, 5 s each, in food or drinks and in artificial saliva for 10 cycles. Baseline and post-immersion Vickers hardness were compared using paired $t$-test. The difference in hardness between the groups was analysed with one-way ANOVA followed by a least significant different (LSD) test.

Results: Cola soft drink significantly reduced surface hardness of enamel, dentine, microfilled composite, and resin modified glass ionomer ($p < 0.05$). Orange juice and sports drink significantly reduced surface hardness of enamel ($p < 0.05$). Drinking yogurt and Tom-yum soup did not reduce surface hardness of any substrate.

Conclusion: This in vitro study confirms the erosive potential of certain acidic food and drinks that public should be aware of.

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Introduction

Consumption behavior plays a major role in oral health. Campaigns have been waged concerning sugar products and dental caries. However, public awareness on dental erosion, another form of tooth surface destruction, is not high. Dental erosion is a result of mineral loss from the tooth surface due to a chemical process of acidic dissolution not involving
acids of bacterial plaque origin. Sources of acids can be endogenous or exogenous, and erosive intensity is modified by quality and quantity of saliva. Acidic food and beverages are the most common extrinsic factors that cause dental erosion. A number of studies has reported the relationship between dental erosion and acidic foodstuffs such as soft drinks, fruit juices, and sour food.

Dietary awareness is an important issue in modern society. The consumption of carbonated drinks is popular with the youth of today and the habit is carried over into adulthood. The popularity of sports drinks has raised questions about their erosive potential. Healthy diets, such as fruits, fruit juices, and yogurt, may as well cause erosion by their acidity. Furthermore, acidity can be an essential element in certain sour dishes. For example, 'Tom-yum', a well-known Thai hot and sour lemon grass soup, was found to reduce surface hardness of enamel [Unpublished student research project, Chulalongkorn University, 2000].

Dental erosion does not only affect enamel. When reaching dentine it can cause hypersensitivity, or in severe cases, pulp exposure and even tooth fracture. Clinical performance of filling materials is affected by erosion as well. Studies reported that acidic condition degraded glass ionomer cements, polyacid modified resin composites, and restorative composite. In the oral environment, saliva modifies the erosive process. Individuals with low or diminished salivary flow were susceptible to erosive tooth damage. Some tooth-coloured filling materials showed an increase in surface hardness after prolonged immersion in saliva.

The objective of this in vitro study was to measure changes in surface hardness of enamel, dentine, and tooth-coloured filling materials after immersion in various acidic food and drinks that represent popular diets, and have the potential to cause acidic erosion in the oral cavity. This tests the hypothesis that surface hardness of enamel, dentine, and tooth-coloured filling materials does not change after immersion in acidic food and drinks. Alternated immersion of substrates in artificial saliva was incorporated as an attempt to simulate the washing effect. The difference in hardness changes exerted by acidic food and drinks as experienced by various substrates were also determined.

Materials and methods

Fifty tooth specimens were prepared from 25 extracted human premolars that were cut bucco-lingually with a slow speed diamond saw (Isomet 1000, Buehler, Lake Bluff, USA). One side of the tooth specimens (buccal or palatal/lingual surface) was randomly assigned as 'enamel', and ground wet to achieve a flat enamel surface using 600, 1000, 1200 grit silicon carbide paper, followed by polishing with 0.2 and 0.05 microns alumina slurry. The other side of the tooth specimen was ground and polished using the same protocol to achieve a flat dentine surface (Fig. 1). The specimens were kept in distilled water at room temperature prior to testing.

Fifty specimens were prepared from each of the five tooth-coloured filling materials listed in Table 1. Each material was placed into a cylindrical acrylic mould (5 mm diameter, 2 mm thick) and covered with a glass cover slip during the curing process. Universal composite and polyacid-modified composite were light cured for 40 s and microfilled composite for 20 s following manufacturers instructions, using a dental curing unit (model 2500, 3M ESPE, St Paul, USA). Specimens cured under the glass cover slip had mirror-smooth surfaces that did not require further grinding or polishing. The cured specimens were kept in distilled water at room temperature before they were tested the same day. Glass ionomers were mixed according to the manufacturers instructions.

Figure 1 Diagram showing enamel and dentine specimen preparation from a premolar. E (enamel) and D (dentine) are areas on the buccal or lingual surface that were ground flat for microhardness measurements. Two specimens of dentine and enamel were achieved from each tooth.
Resin-modified glass ionomer specimens were light cured for 20 s, and conventional glass ionomer specimens were left in the mould for 6 min to harden. All glass ionomer specimens were kept in distilled water for 24 h before testing.

Baseline microhardness measurements were performed using a Vickers indentor attached to a microhardness tester (model FM 700e, FutureTech, Tokyo, Japan). Six indentations per test were performed on each specimen. The indentation load was 100 g with 15 s dwell time. For the enamel and dentine specimens, the indentations were made in the cervical area of the buccal and lingual surfaces, with at least 300 μm between indentations. For the tooth-coloured filling material specimens, the indentations were positioned to cover most of the specimen surface, which resulted in wider spaced indentations.

After baseline microhardness was recorded, the specimens were alternately immersed manually, 5 s each, in 32.5 ml of acidic food or drink (Table 2) and in artificial saliva for 10 cycles at room temperature. The specimen soaking protocol was simulated from an individual drinking a can of soft drink (325 ml). Total soaking time was 100 s. After the soaking sequence was completed the specimen was rinsed with distilled water, blotted dry, and subjected to post-immersion microhardness testing.

Vickers hardness numbers of the baseline and post-immersion measurements were compared using paired t-test. The differences in hardness after immersion were compared between types of food and drinks using one-way ANOVA followed by a least significant different (LSD) test.

The acidity of each food and drink was measured (n = 7) with a pH meter (model 420A, Orion Research Inc, Boston, USA). In addition, the neutralisable acidity was determined, in triplicate, as the volume of 0.1 M sodium hydroxide solution added to 20 ml of the tested food or drink to reach pH 7.0.

Results

Vickers hardness numbers (VHN) of the baseline and post-immersion measurements are shown in Table 3. Enamel hardness decreased significantly (p < 0.05) after immersion in Cola soft drink, orange juice, and sports drink. Surface hardness of dentine, microfilled composite, and resin-modified glass ionomer decreased significantly (p < 0.05) after immersion in Cola soft drink. Surface hardness

<table>
<thead>
<tr>
<th>Food/drink</th>
<th>Products</th>
<th>Manufacturer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cola soft drink</td>
<td>Coke</td>
<td>Thainumtip, Bangkok, Thailand</td>
<td>Carbonated water, 10% sugar, flavors</td>
</tr>
<tr>
<td>Orange juice</td>
<td>Tipco</td>
<td>Tipco Foods CO. Ltd. Prajubkirkhan, Thailand</td>
<td>100% tangerine juice</td>
</tr>
<tr>
<td>Sports drink</td>
<td>Sponser</td>
<td>T.C. Pharmaceutical Ltd., Bangkok, Thailand</td>
<td>Carbonated drink with minerals</td>
</tr>
<tr>
<td>Drinking yogurt</td>
<td>Dutchmill</td>
<td>Dutch mill Ltd., Nakornpathom, Thailand</td>
<td>53% yogurt, 16% mixed juice, 8% sugar</td>
</tr>
<tr>
<td>Tom-yum soup</td>
<td>Knorr</td>
<td>Knorr, CPC/AJI (Thailand) Ltd., Chachoengsao, Thailand</td>
<td>2 cubes in 1 L boiling water. Each cube contained 5% citric acid, 1.5% lime juice, salt, spices, paprika, palm oil</td>
</tr>
<tr>
<td>Artificial saliva</td>
<td>Composition:</td>
<td>2.22 g/L gastric mucin, 0.381 g/L sodium chloride, 0.231 g/L calcium chloride, 0.738 g/L potassium phosphate, 1.1144 g/L potassium chloride, 0.02% sodium azide, trace of sodium hydroxide to pH 7.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Tooth-coloured filling materials used in the present study.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>Products</td>
</tr>
<tr>
<td>Universal composite</td>
<td>Filtek™ Z250 A2</td>
</tr>
<tr>
<td>Microfilled composite</td>
<td>Filtek™ A110 A2E</td>
</tr>
<tr>
<td>Conventional glass ionomer</td>
<td>GC Fuji IXGP A2</td>
</tr>
<tr>
<td>Resin-modified glass ionomer</td>
<td>GC Fuji II LC A2</td>
</tr>
<tr>
<td>Polyacid modified resin composite</td>
<td>Dyract AP A2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Acidic food and drinks and the composition of artificial saliva used in the present study.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food/drink</td>
<td>Products</td>
</tr>
<tr>
<td>Cola soft drink</td>
<td>Coke</td>
</tr>
<tr>
<td>Orange juice</td>
<td>Tipco</td>
</tr>
<tr>
<td>Sports drink</td>
<td>Sponser</td>
</tr>
<tr>
<td>Drinking yogurt</td>
<td>Dutchmill</td>
</tr>
<tr>
<td>Tom-yum soup</td>
<td>Knorr</td>
</tr>
<tr>
<td>Artificial saliva</td>
<td>Composition:</td>
</tr>
</tbody>
</table>
of universal composite, conventional glass ionomer, and polyacid-modified resin composite did not change in any food or drink tested ($p > 0.05$).

Table 4 shows mean hardness changes (ΔVHN) of each substrate in acidic food and drinks. The softening effect of Cola was higher than any other tested food or drink on enamel, dentine, microfilled composite, and resin-modified glass ionomer ($p < 0.05$). The sports drink significantly reduced hardness of enamel more than the drinking yogurt or Tom-yum soup ($p < 0.05$). There was no significant difference in hardness changes between orange juice, drinking yogurt, and Tom-yum soup in all substrates under the present test condition ($p > 0.05$). Hardness changes from the drinking yogurt and Tom-yum soup were minute under the testing conditions used in this study.

The pH and neutralisable acidity for the food and drinks are shown in Table 5. Cola had the lowest pH and Tom-yum soup had the highest pH value. Orange juice and drinking yogurt were more difficult to neutralise than Cola, sports drink, and Tom-yum soup.

**Table 3** Mean (SD) Vicker hardness number (VHN) of substrates at baseline and after immersion in acidic food or drink.

<table>
<thead>
<tr>
<th>Substrate</th>
<th>Food or drink</th>
<th>Baseline VHN</th>
<th>Post-immersion VHN</th>
<th>$p$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enamel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cola</td>
<td>271.9 (14.4)</td>
<td>172.1 (12.3)</td>
<td>0.000*</td>
<td></td>
</tr>
<tr>
<td>Drinking yogurt</td>
<td>265.4 (18.4)</td>
<td>262.3 (16.7)</td>
<td>0.695</td>
<td></td>
</tr>
<tr>
<td>Orange juice</td>
<td>266.1 (15.9)</td>
<td>249.8 (21.7)</td>
<td>0.030*</td>
<td></td>
</tr>
<tr>
<td>Sports drink</td>
<td>265.9 (25.1)</td>
<td>238.2 (19.3)</td>
<td>0.004*</td>
<td></td>
</tr>
<tr>
<td>Tom-yum soup</td>
<td>260.3 (28.2)</td>
<td>259.8 (27.9)</td>
<td>0.635</td>
<td></td>
</tr>
<tr>
<td><strong>Dentine</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cola</td>
<td>46.3 (1.7)</td>
<td>43.0 (2.0)</td>
<td>0.000*</td>
<td></td>
</tr>
<tr>
<td>Drinking yogurt</td>
<td>51.0 (5.1)</td>
<td>51.0 (5.3)</td>
<td>0.937</td>
<td></td>
</tr>
<tr>
<td>Orange juice</td>
<td>50.2 (2.0)</td>
<td>49.4 (2.3)</td>
<td>0.281</td>
<td></td>
</tr>
<tr>
<td>Sports drink</td>
<td>52.7 (4.4)</td>
<td>52.3 (5.0)</td>
<td>0.229</td>
<td></td>
</tr>
<tr>
<td>Tom-yum soup</td>
<td>51.3 (2.7)</td>
<td>51.1 (2.7)</td>
<td>0.053</td>
<td></td>
</tr>
<tr>
<td><strong>Universal composite</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cola</td>
<td>76.1 (1.2)</td>
<td>74.7 (2.7)</td>
<td>0.112</td>
<td></td>
</tr>
<tr>
<td>Drinking yogurt</td>
<td>72.6 (5.3)</td>
<td>72.1 (4.4)</td>
<td>0.204</td>
<td></td>
</tr>
<tr>
<td>Orange juice</td>
<td>73.9 (2.7)</td>
<td>73.1 (3.7)</td>
<td>0.149</td>
<td></td>
</tr>
<tr>
<td>Sports drink</td>
<td>76.2 (2.5)</td>
<td>75.5 (2.3)</td>
<td>0.227</td>
<td></td>
</tr>
<tr>
<td>Tom-yum soup</td>
<td>75.3 (2.7)</td>
<td>74.8 (2.0)</td>
<td>0.130</td>
<td></td>
</tr>
<tr>
<td><strong>Microfilled composite</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cola</td>
<td>35.4 (2.7)</td>
<td>33.2 (2.8)</td>
<td>0.001*</td>
<td></td>
</tr>
<tr>
<td>Drinking yogurt</td>
<td>36.1 (1.7)</td>
<td>35.9 (1.7)</td>
<td>0.536</td>
<td></td>
</tr>
<tr>
<td>Orange juice</td>
<td>36.3 (2.1)</td>
<td>35.6 (2.4)</td>
<td>0.061</td>
<td></td>
</tr>
<tr>
<td>Sports drink</td>
<td>36.0 (1.4)</td>
<td>35.8 (1.3)</td>
<td>0.068</td>
<td></td>
</tr>
<tr>
<td>Tom-yum soup</td>
<td>33.6 (1.4)</td>
<td>33.5 (1.3)</td>
<td>0.172</td>
<td></td>
</tr>
<tr>
<td><strong>Conventional glass ionomer</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cola</td>
<td>59.1 (1.6)</td>
<td>59.2 (1.3)</td>
<td>0.673</td>
<td></td>
</tr>
<tr>
<td>Drinking yogurt</td>
<td>59.8 (1.8)</td>
<td>60.2 (1.5)</td>
<td>0.393</td>
<td></td>
</tr>
<tr>
<td>Orange juice</td>
<td>59.1 (1.6)</td>
<td>58.4 (1.5)</td>
<td>0.116</td>
<td></td>
</tr>
<tr>
<td>Sports drink</td>
<td>58.6 (1.7)</td>
<td>58.3 (1.6)</td>
<td>0.090</td>
<td></td>
</tr>
<tr>
<td>Tom-yum soup</td>
<td>59.2 (1.6)</td>
<td>59.0 (1.7)</td>
<td>0.557</td>
<td></td>
</tr>
<tr>
<td><strong>Resin-modified glass ionomer</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cola</td>
<td>39.2 (2.4)</td>
<td>37.2 (2.3)</td>
<td>0.000*</td>
<td></td>
</tr>
<tr>
<td>Drinking yogurt</td>
<td>38.4 (1.7)</td>
<td>38.3 (1.8)</td>
<td>0.508</td>
<td></td>
</tr>
<tr>
<td>Orange juice</td>
<td>39.2 (1.6)</td>
<td>39.3 (1.4)</td>
<td>0.825</td>
<td></td>
</tr>
<tr>
<td>Sports drink</td>
<td>38.7 (1.5)</td>
<td>38.4 (1.6)</td>
<td>0.089</td>
<td></td>
</tr>
<tr>
<td>Tom-yum soup</td>
<td>38.6 (1.8)</td>
<td>38.4 (1.6)</td>
<td>0.263</td>
<td></td>
</tr>
<tr>
<td><strong>Polyacid-modified resin composite</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cola</td>
<td>45.3 (2.6)</td>
<td>44.0 (2.3)</td>
<td>0.124</td>
<td></td>
</tr>
<tr>
<td>Drinking yogurt</td>
<td>40.4 (1.7)</td>
<td>39.8 (1.2)</td>
<td>0.279</td>
<td></td>
</tr>
<tr>
<td>Orange juice</td>
<td>42.1 (1.4)</td>
<td>41.9 (1.7)</td>
<td>0.445</td>
<td></td>
</tr>
<tr>
<td>Sports drink</td>
<td>42.4 (1.3)</td>
<td>42.2 (1.5)</td>
<td>0.083</td>
<td></td>
</tr>
<tr>
<td>Tom-yum soup</td>
<td>42.1 (1.8)</td>
<td>42.0 (1.8)</td>
<td>0.454</td>
<td></td>
</tr>
</tbody>
</table>

*Denotes statistically significant difference ($p < 0.05$). $n = 10$. 

**Discussion**

During consumption, food or drink contacts only shortly with the tooth surfaces before it is washed away by saliva. In previous studies, substrates...
usually contacted acidic foodstuffs for a prolonged period of time or did not account for the role of saliva.8–10 This study was designed to simulate the washing effect of saliva of an individual drinking a can of soft drink (325 ml) by cyclic specimen immersion. We extended this model to other food and drinks to achieve a controlled condition, even though the period of consuming other diets can be different. Other protective effects of saliva such as buffering capacity, acquired pellicle, or remineralisation could not be simply reproduced in vitro.

Baseline microhardness values for enamel in this study ranged from 260 to 279 VHN. These values are similar as in a study by Meredith et al.17, but lower than the value reported by Maupome et al. 10 Our study design required a sufficiently flat and large area to enable 12 indentations. Thus the area subjected to erosion was not the original surface enamel, and potentially more susceptible to erosion. Microhardness decreases from the outer enamel surface toward the dentinoenamel junction17, which explains our low baseline values. In the present study, the baseline and post-immersion measurements for each specimen were carried out in the same plane. Dentine microhardness, ranging from 46 to 53 VHN, is similar to previous studies.18,19 Microhardness of tooth-coloured filling materials were also in the same range as values reported by other investigators.15

Hardness measurements were performed on both buccal and palatal/lingual enamel. Under clinical conditions, palatal/lingual enamel has been reported to be more susceptible to erosion than buccal enamel.20,21 A lower erosion rate of buccal enamel could be a result of its location, which would allow better access to parotid saliva or less frequent contact with acid. In this study we randomised the buccal and palatal/lingual enamel used in the measurements and thus reduced the effect of surface location. Hardness measurements of dentine have also been studied in previous publications.18,19 On a microscale level, dentine hardness is location dependent due to the different properties of peritubular and intertubular dentine or air-filled dentinal tubules. With the 100 g dwell load applied to the indentor in the present study, the size of indentation was approximately 60×60 μm², which covered a dentine area large enough to achieve consistent average values.

The results from this study indicate that Cola soft drink caused greatest reduction in hardness values of enamel, followed by sports drink and orange juice (Table 4). A similar effect of beverages on erosion has been shown in previous studies.3,8–10 It should be emphasised that our soaking protocol was relatively short, 10 cycles of 5 s in acidic foodstuffs alternated with 5 s immersion in artificial saliva. Some of the drinks are normally consumed chilled, while Tom-yum soup is consumed hot. The temperature of food stuffs affect the extent of erosion.22 In this study we evaluated them all at room temperature.

In general, foodstuffs with lower pH have greater erosive effect.8,9 We found that Cola soft drink which had pH of 2.74, the lowest among tested food and drinks, caused the highest change in surface hardness of tooth structures (Table 4). Enamel was softened by sports drink and orange juice, but not by drinking yogurt, although all three drinks had similar pH, between 3.75 and 3.83 (Table 5). Evidently, pH is not the only factor affecting enamel erosion. Buffering capacity and titratable

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Mean difference in surface hardness (Δ VHN) of substrates before and after immersion in acidic food or drink.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food/drink</td>
<td>E</td>
</tr>
<tr>
<td>Cola</td>
<td>99.77a</td>
</tr>
<tr>
<td>Sports drink</td>
<td>27.71b</td>
</tr>
<tr>
<td>Orange juice</td>
<td>16.35b,c</td>
</tr>
<tr>
<td>Drinking yogurt</td>
<td>3.14b</td>
</tr>
<tr>
<td>Tom-yum soup</td>
<td>0.53c</td>
</tr>
</tbody>
</table>

Letters denote values within column that are not significantly different (p>0.05). E=Enamel; D=Dentin; U=Universal composite; M=Microfilled composite; GI=Conventional glass ionomer; RMGI=Resin-modified glass ionomer; PMC=Polyacid-modified resin composite.

<table>
<thead>
<tr>
<th>Table 5</th>
<th>Mean (SD) pH (n=7) and neutralisable acidity (n=3) of food and drinks.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food/drink</td>
<td>pH</td>
</tr>
<tr>
<td>Cola soft drink</td>
<td>2.74 (0.01)</td>
</tr>
<tr>
<td>Orange juice</td>
<td>3.75 (0.01)</td>
</tr>
<tr>
<td>Sports drink</td>
<td>3.78 (0.01)</td>
</tr>
<tr>
<td>Drinking yogurt</td>
<td>3.83 (0.01)</td>
</tr>
<tr>
<td>Tom-yum soup</td>
<td>4.20 (0.00)</td>
</tr>
</tbody>
</table>
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acidity can modify the erosive process. Sports drink was easier to neutralise than orange juice and yogurt (Table 5). Lussi et al. reported that enamel surface was not softened in yogurt because of the high concentration of calcium and phosphate. Calcium and phosphate content saturate the drink with respect to apatite. Other components, such as fluoride, also affect the erosive capacity.

Our result did not show reduction in surface hardness of enamel induced by Tom-yum soup. The duration of exposure used in this study was rather short for a meal because we applied the contact period for drinking a can of Cola in all food and drinks. Frequency, duration, temperature, and manner of exposure to acidic food and drinks has been shown to affect the extent of erosion.

This study showed that sports drink and orange juice significantly decrease hardness of enamel, but not dentine. This can be explained by the difference in composition of the two hard tissues. Enamel, composed of 87 vol% inorganic substance, is readily dissolved in an acidic environment. Dentine, on the other hand, has 47 vol% inorganic substance, thus is less susceptible to acid attack.

Tooth-coloured filling materials reportedly display a tendency to erode under acidic conditions. We found hardness values of microfilled composite and resin-modified glass ionomer significantly reduced after immersion in Cola soft drink. However, hardness values of universal composite, polyacid-modified resin composite, and conventional glass ionomer did not significantly change. Organic acids were found to induce softening of bis-GMA based polymers. The higher resin content of microfilled may be the reason for greater hardness reduction in comparison to universal resin composite.

The mean microhardness difference (ΔVHN) for the conventional glass ionomer with drinking yogurt and resin-modified glass ionomer with orange juice were negative (Table 4), i.e. the materials hardened after the immersion process. A previous in vitro study found an increase hardness of a conventional glass ionomer after prolonged immersion in saliva due to diffusion of calcium and phosphate ions to the surface. The increased hardness that we observed was so small that it is likely the result of measurement variation.

In this in vitro study Cola soft drink, sports drink, and orange juice softened enamel surface despite the relatively short contact period (10 cycles of 5 s each) between substrates and the acidic foodstuffs. This experimental result is not the only predictor of clinical outcome. Salivary protective effect plays a major role in moderating the extent of erosion in the mouth. Tooth brushing or abrasion, on the other hand, may intensify the erosive process. Further research to better understand the exact mechanisms in the progression of erosion is needed. Although this study could not completely replicate the complex oral environment, it confirms the erosive potential of certain acidic food and drinks that the public should be aware of.

Conclusions

During a short period of contact, which simulated drinking a can of soft drink, Cola significantly reduced surface hardness of enamel, dentine, microfilled composite, and resin modified glass ionomer. Enamel surface was also softened by orange juice and a sports drink. Drinking yogurt and Tom-yum soup did not reduce surface hardness of any substrate tested.

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