Short Communication

Comparison of Acid Clearance of Noncarbonated and Carbonated Soft Drinks in the Mouth

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The aim of this study was to measure differences in oral pH after subjects drank carbonated and noncarbonated acidic soft drinks. Oral pH was measured in 17 subjects at 4 oral sites with beetrode electrodes after each subject drank 50 mL of noncarbonated and carbonated blackcurrant beverages. There were no statistical differences for either beverage regarding the time taken to recover a pH of 5.5, 6.0, and 6.5. Oral pH recovered to 6.5 within 90 seconds with both drinks. The median lowest pH recorded after 30 seconds at the 4 sites for both drinks was > pH 4.9, but there was no statistical difference in the clearance between the drinks. The implication may be that carbonation is not directly responsible for the erosive potential of different beverages. *Int J Prosthodont 2007;20:181–182.*

A recent study compared the oral clearance of dietary acids in 10 patients with tooth erosion to controls.[1] Oral pH was measured at 4 sites in the mouth after subjects drank an acidic beverage, and the results showed no statistical differences between the 2 groups. This implies that another factor may important in the development of dental erosion.

Carbonation has been frequently cited as a potential cause of dental erosion.[2] The aim of this study was to investigate the erosive potential of carbonation in a common dietary acidic beverage by measuring oral pH in vivo. The null hypothesis was that the carbonation of a beverage does not affect oral clearance.

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Materials and Methods

Seventeen medically fit and healthy subjects (11 women and 6 men) with a median age of 32.1 years (interquartile range, 29 to 35 years) were recruited from patients undergoing routine care at King's College London Dental Institute. Ethical approval was obtained from the Guy's Hospital Research Ethics Committee. The volunteers had a minimum of 20 permanent teeth without evidence of pathologic tooth wear. Saliva was assessed using previously published techniques.[1] A 50-mL sample of a noncarbonated (pH 2.75, titratability 1.8 mL) and a carbonated (pH 2.44, titratability 2.7 mL) version of the same blackcurrant beverage (Ribena, GSK) was titrated with 0.1-mL increments of 1 mol/L sodium hydroxide until reaching pH 7.0. Beetrode microtouch electrodes, with a separate reference electrode, recorded the oral pH at 4 soft tissue sites in the mouth: the tip and dorsum of the tongue, the buccal mucosa adjacent to the mandibular molars, and the labial mucosa adjacent to the maxillary central incisors.[1] A fresh 15-mL sample of either the carbonated or noncarbonated beverage was given in random order to each subject. The subjects were instructed to swirl each drink in their mouths for 45 seconds before swallowing. All clinical measurements were taken at the same time of day (midday) to avoid diurnal variation. Data were analyzed for the lowest pH reached at each site and the time to reach pH 5.5, 6.0, and 6.5. The Wilcoxon matched pairs signed rank test was used to compare the data.

Table 1 Median (Interquartile Range) of the Lowest pH Recorded at the Different Oral Sites of the Subjects While Consuming the 2 Drinks

	Lowest pH recorded	
Site	Carbonated	Noncarbonated
Tip of the tongue	5.0 (4.6–5.5)	4.9 (4.6–5.2)
Dorsum of the tongue	5.2 (4.8–5.4)	5.4 (4.8–5.7)
Buccal mucosa	5.2 (5.0–6.2)	5.4 (5.1–6.1)
Labial mucosa	4.8 (4.5–5.5)	5.0 (4.5–5.6)

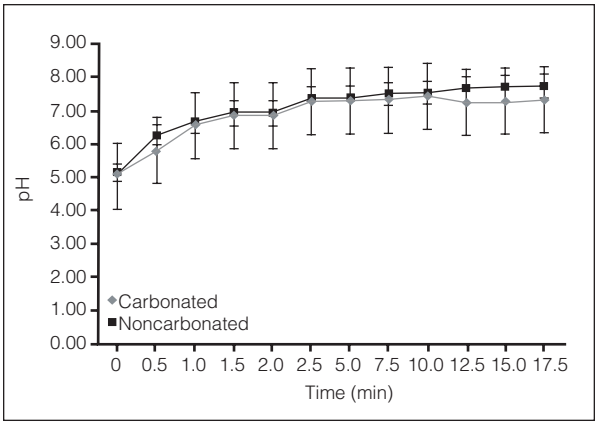

Fig 1 *(right)* Median pH of all subjects at the tip of the tongue after drinking the noncarbonated and carbonated beverages.

Table 2 Median (Interquartile Range) Time (seconds) to Reach pH 5.5, 6.0, and 6.5 at Different Oral Sites After Drinking the 2 Drinks

	Time to reach pH 5.5		Time to reach pH 6.0		Time to reach pH 6.5	
Site	Carbonated	Noncarbonated	Carbonated	Noncarbonated	Carbonated	Noncarbonated
Tip of the tongue	30 (0–60)	30 (30–60)	60 (30–90)	30 (30–90)	90 (60–90)	90 (60–120)
Dorsum of the tongue	30 (30–30)	30 (0–60)	60 (30–90)	90 (0–90)	120 (60–450)	120 (60–150)
Buccal mucosa	30 (0–30)	30 (0–30)	60 (0–90)	60 (0–90)	60 (30–300)	90 (0–150)
Labial mucosa	75 (0–210)	45 (0–210)	90 (30–450)	60 (30–600)	120 (30–600)	150 (90–750)

Results

The mean pH (titratable acidity) readings of the noncarbonated and carbonated blackcurrant beverages were 2.75 (1.8 mL) and 2.44 (2.7 mL), respectively. All subjects had normal salivary parameters. The lowest pH was recorded on the labial mucosa, while the buccal mucosa showed the least decrease in pH (Table 1). Both the tip and dorsum of the tongue responded similarly. The times taken to reach pH 5.5, 6.0, and 6.5 were similar among the tested sites, with the labial mucosa showing the longest response time (Fig 1 and Table 2). A median of 2 minutes was taken to reach pH 6.5 at all sites with both beverages. The longest time to reach pH 6.5 was recorded at the labial mucosa with both beverages. There were no significant differences at any site between the 2 beverages regarding the lowest pH and the time taken to reach pH 5.0, 5.5, and 6.0.

Discussion

The sites chosen for oral pH measurement were adjacent to common areas of dental erosion. In most cases, the median time taken to reach pH 6.5 at all sites was below 90 seconds, which illustrates the efficiency of oral clearance.[3] The maximum time to reach pH 6.5 was over 17 minutes for 4 subjects (2 after the carbonated and 2 after the noncarbonated beverage). The salivary data were normal and so are unlikely to account for the differences recorded in these subjects. However, these subjects had no evidence of erosion and support the findings of previous work that suggests there is variation between individuals in oral clearance.[4] The lowest pH was recorded on the buccal mucosa adjacent to the maxillary incisors, which is not surprising since this is the first point of contact between the dietary acid and oral tissues and is furthest from the salivary glands.[4] Previous research showed no differences in clearance between patients with dental erosion and controls. Combined with the results of the present study, this suggests that neither carbonation nor clearance of acidic beverages influences erosion. This study showed no significant differences in oral pH at the 4 sites between the 2 drinks, even though the carbonated beverage had a slightly lower pH and higher titratable acidity.

References

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