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Dental erosion in children: risk factors in daily life in the 21st century

Gambon, D.L.

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Summary

Chapter 1

Dental erosion is the loss of dental hard tissue that is chemically etched away from the tooth surface by acid without bacterial involvement. The prevalence of erosive tooth wear is still increasing, especially in the younger age groups. This has been attributed to changes in nutritional habits and lifestyle, which provided the basis for further research described in this thesis.

Today many children and adolescents spend a lot of time behind their computers. Some of them are eating small amounts of (acidic) food and/or drinking soft drinks with small sips, while gaming over a longer period of time. Therefore, they form a group at risk for erosive wear of their dentition. In combination with parafunctional habits, e.g. bruxism, this can lead to severe tooth wear.

This was illustrated by the case report of a 9-year-old boy. He consumed one single glass of soft drink while he was gaming intensively on his computer, and developed severe tooth wear at young age.

Chapter 2

Schools are in a unique position to improve the health status and dietary behaviour of children. School canteens provide children with a wide range of food choices, which may include risk factors for developing dental erosion. Therefore, we performed a cross-sectional study among 43 locations of 37 secondary schools in the Netherlands. This study showed that many different products are available in canteens of Dutch secondary schools, a high proportion of the drinks being potentially erosive ($71.8 \pm 12.9\%$). The number of different products available, the number of different beverages available and the number of erosive drinks were all related to the number of students per school, but not to the type of education. The number of drinks available and the number of erosive drinks correlated with the opening hours of the canteens and the number of vending machines.

Consumption of the potentially erosive products during school hours may contribute to the development of dental erosion in school children. Restrictions on the canteen assortment, a reduction in opening hours of the canteen and/or a ban on vending machines could help to limit the exposure of Dutch school children to potentially erosive drinks.

Chapter 3

Several observational studies support an association between soft drink consumption and the incidence or severity of dental erosion. However, the observation that several other studies failed to demonstrate, a relationship between dental erosion and consumption of acidic beverages, indicates that focussing on a single type of drink may be too simplistic. Therefore,

we explored the possible associations in consumption of various types of potentially erosive beverages among adolescent school children.

A cross-sectional single centre study was performed among 502 school children in Rotterdam, the Netherlands, in age varying between 12 and 19 years old. Boys consumed soft drinks, energy drinks and sports drinks more frequently than girls, and on average boys also consumed higher amounts of these drinks. No gender-related differences were observed in alcopop consumption. Consumption of all drinks was most frequent at 14 or 15 years of age, with the exception of alcopops which was most frequent by 16 years old school children. Significant positive associations were observed between the consumption of soft drinks, energy drink and/or sports drinks. Alcopop consumption was only associated with consumption of energy drinks.

Chapter 4-7

Different types of acidic candy may potentiate the risk on dental erosion. Therefore, the effects on salivary flow rate, buffer capacity and pH were studied of various types of candies, such as candy sprays, lollipops, jawbreakers, winegums, gumballs, strawberry stripes and fruitgum. All candies contained an organic acid, such as citric acid, malic acid and/or fumaric acid. Due to the presence of the organic acids, consumption of the candies increased the salivary flow rate greatly. Despite this increase in salivary flow rate, consumption of acidic candies induced a strong drop in salivary pH to values (far) below 5.5, the critical pH for dissolving dental enamel. The largest drop in salivary pH was observed during consumption of the candy sprays. However, the size of the hard candy may also play a role. The longest decrease in salivary pH was observed during consumption of fruit-flavoured and cola-flavoured lollipops. After removal of the candy from the mouth, both the pH and the salivary secretion rate normalized rapidly.

When consumption of acidic candies is limited to a single piece (or a single dose of candy spray), the length of the acidic attack is probably too short for permanent damage to the dental surface. During consumption of lollipops or jawbreakers, however, the teeth are much longer exposed to acid, resulting in a longer period of time for dissolution of dental mineral and a shorter time for remineralisation. Some lollipops contain extra calcium, which will decrease the critical pH value at which dissolution of hydroxyapatite occurs. As candy sprays and some other types of acidic candies are more frequently used by children and the volume of saliva in children is smaller than in adults, the erosive potential of these candies seems to be higher in children.

Chapter 8

To prevent development of dental erosion, the frequency and the severity of contact with acidic beverages should be reduced. Several authors advise to consume acidic beverages with a drinking straw positioned towards the back of the oral cavity. This will reduce the contact time between the teeth and the acidic drink, and tends to direct liquid away from the anterior

teeth reducing its erosive action. However, several case reports have been published that a straw placed labial to the anterior teeth may result in rapid development of erosion of these frontal teeth.

In a paediatric dental clinic we observed some children with a remarkable pattern of abrasion and erosion of the primary maxillary incisors. Most of these children were biting on their straw while drinking. Therefore, we investigated the frequency with which young children bite on straws during drinking. Straws were collected after being used by children (n=421) between 4 and 6 years old and classified as undamaged, damaged without deformation or damaged with deformation. Only 11% of the straws were undamaged, 60% were damaged and 29% were damaged with deformation. The highest percentages of damaged and deformed straws were observed in 4-year-old children.

In a subsequent study, we explored the potential relation between this straw biting habit and dental tissue loss. The primary maxillary incisors of another group of 69 children (4 - 7 years) were photographed, and the photographs were scored by two dentists with regard to tooth wear. The parents of these children provided information about consumption pattern and the use of straws. Of this second group of children, more than 80% were classified as having tooth wear or dental erosion. The presence of tooth wear and dental erosion incisally on the upper incisors were both related to the habit of damaging straws during beverage consumption.

These preliminary studies show that many young children chew on their drinking straws while using them. When tooth wear of the primary maxillary incisors is observed in children, dental health care workers should discuss the possible (incorrect) use of straws with their parents.

Conclusion

A general conclusion from this thesis is that many factors in the 21st century can lead to dental erosion in (young) children and adolescents. Knowledge of the risk factors and protecting factors is a prerequisite for prevention of dental erosion. Therefore, the parents and children should receive comprehensive information about the risks of the intake of acid food and drinks, as well as recommendations about toothfriendly eating and drinking habits.