Short reports

Oral candida: is dummy carriage the culprit?

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SUMMARY Oral candida in subjects who sucked dummies was almost double that of controls. Although the carriage of *Candida albicans* on silicone dummies was significantly reduced compared with latex dummies, oral colonisation was unaffected, suggesting that dummy carriage is not the cause of the observed increase.

The use of dummies has recently been shown to be associated with a higher incidence of oral candidiasis and persistent colonisation in acutely ill infants, possibly because of carriage on the dummy.¹

Dummies are usually manufactured from latex rubber, but a dummy made of silicone rubber has recently become available. We wondered, therefore, whether the relation between dummy usage and oral candida was also true of healthy children and whether the smoother surface of a silicone dummy would be associated with less adhesion of candida and reduced oral colonisation.

Subjects and methods

Subjects. Ninety five healthy children, aged 1-24 months, attending a well baby clinic, were entered into the study. Those with symptomatic oral candidiasis or other forms of oral abnormality, or both, were excluded. Informed parental consent and research ethical approval were obtained.

Methods. All those who did not use dummies were allocated to group A (controls); those who did use dummies were randomly allocated to either group B (continued use of a new latex dummy throughout the study, n=26) or group C (changed to a new silicone dummy at the beginning of the study, n=26). Where appropriate, mothers were issued with two dummies and instructions to carry on with their usual practice of dummy care. Oral examination was performed, and swabs taken from the

tongue, hard palate, and dummies at the start of the study and after eight and 16 weeks. Swabs used for dummy culture were moistened in sterile saline solution and rubbed over the entire surface of the dummy before transport to the Children's Hospital, Birmingham. Swabs were plated on Sabouraud's agar (dextrose) and incubated at 37°C for 48 hours. Yeast colonies were classified on the basis of sucrose fermentation, germ tube production, and assimilation reactions using the API 20 C Auxanogramme. Scanning electronmicroscopy was performed on representative dummies from each group.

Statistical analyses were performed using the χ^2 test.

Results

None of the children developed oral candidiasis. The overall incidence of colonisation with candida in those who used dummies at the start of the study was almost twice that of controls (52% v 28%, $p<0.02$); a similar difference was observed for colonisation by *Candida albicans* alone (31% v 12%, $p<0.05$).

After eight weeks 26% of the controls and 62% of those using latex dummies were colonised by *Candida* spp ($p<0.01$). Although only 46% of the group using silicone dummies were now colonised by *Candida* spp, this difference was not significantly lower than that of the group using latex dummies. Similarly, the incidence of colonisation by *C. albicans* alone did not differ significantly in the groups using silicone and latex dummies (23% v 31%, respectively).

Although after 16 weeks the overall growth of *Candida* spp was significantly increased in the group using silicone dummies compared with the group using latex dummies, the incidence of colonisation with *C. albicans* was again unchanged. By this stage of the study, however, 50% of the group who had started with latex dummies only were using both dummies, whereas 78% of the group using silicone

Figure (a) Scanning electronmicrograph of a representative silicone rubber dummy at the end of a 16 week period, depicting the almost unchanged smooth surface of the dummy. (b) Scanning electronmicrograph of a representative latex rubber dummy at the end of a 16 week period, showing the markedly fissured surface of the dummy.

dummies were still using only one ($p < 0.05$), contrary to our initial request. There seemed to be no other difference in dummy care between groups.

To establish the role of carriage of *C. albicans* on the dummy in oral colonisation, the proportion of children with mouth cultures that were positive for *C. albicans* who also had cultures on their dummies—that is, carriage rate on dummies—was studied. Although there was no difference in the rate of oral *C. albicans* colonisation between the two groups, the carriage rate of *C. albicans* on the silicone dummies (22%) was significantly less than on the latex dummies (75%) ($p < 0.05$).

In contrast with previous studies, a wide variety of non-pathogenic *Candida* spp were isolated and in total slightly exceeded those of *C. albicans*—namely, *C. albicans* 46% of all isolates, *C. parapsilosis* 37%, *C. lusitaniae* 8%, *C. guilliermondii* 68%, *Torulopsis candida* 2%, and *C. tropicalis* 1%.

Scanning electronmicrographs (Figure) showed that the initial smooth appearance of both dummies was almost unchanged in the silicone dummies, whereas the latex dummies had become markedly fissured.

Discussion

The twofold increase in oral candida colonisation seen in our healthy population of dummy users confirms the previous observations of Manning *et al* in acutely ill infants.¹ Such an increase may be related to the presence of foreign bodies in the mouth, similarly observed among denture wearers.²

Moreover, illness seems to predispose to colonisation with *C. albicans* and clinical candidiasis, for the overall incidence in ill children was higher than in our healthy population.

Although the rates of colonisation with *C. albicans* were unchanged at the end of the study, the use of a silicone dummy was associated with a lower rate of carriage of *C. albicans* on the dummy. The finding of pronounced differences in surface morphology of the two types of dummies may be important (Figure).

These observations therefore suggest that the increased predisposition to oral colonisation with *C. albicans* that occurs with dummy usage does not happen simply from dummy carriage but results from a more subtle disturbance in the ecosystem of the mouth, the nature of which remains speculative.

The clinical importance of increased colonisation with species other than *C. albicans* in the dummy sucking group is difficult to assess. Although these species are usually considered to be non-pathogenic to man, opportunistic infections with *C. lusitaniae*, *C. guilliermondii*, and *C. tropicalis* have been described.³⁻⁵ These observations may therefore be relevant in the immunocompromised dummy user who is undergoing attempted gut sterilisation.

The British Standards Institute has expressed its concern over the inadequacy of the current standard on babies' dummies, BS5239, particularly in relation to the spike test. After adverse publicity the manufacturers of silicone dummies have voluntarily withdrawn their products from sale pending revision to the safety standard, which is expected in early 1987.

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Mechanism of erroneous Dextrostix readings

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SUMMARY The mechanism of hyper-reactivity of the Dextrostix system when contaminated with alcoholic skin cleaning agents was investigated. When sodium fluoride was supplied to block glucose oxidase activity and hydrogen peroxide was exogenously provided benzidine peroxidation could be preferentially studied. Benzidine hydrochloride was the most likely site of the hyper-reaction.

Repeated measurement of blood sugar is especially important in newborn infants who are susceptible to hypo- and hyperglycaemia. Dextrostix (Ames Co, United States) is a blood sugar measuring system that uses dry chemistry and is often used in intensive care medicine because of its accuracy and convenience.¹ The system consists of two enzymatic steps:

where ox-benzidine is the oxidised form of benzidine. These reactions are highly dependent on the quantity of glucose. The system does not respond to reduced sugars, and substances such as lactose, fructose, galactose, glutathione, ascorbic acid, uric acid, creatinine, amino acid, and glycolytic intermediate in its routine clinical use. Haemolysis, bilirubin, and the addition of glycolysis blocking

agents, such as ascorbic acid, are known to interfere with the system.^{2,3}

Isopropyl alcohol, often used during the preparation of the blood sampling site, causes an erroneously high glucose reading as measured by Dextrostix.^{4,5} In the present study we investigated the mechanism of serum glucose measurement when the Dextrostix system was contaminated with various alcoholic agents and reiterate the potential problems of interpreting such factitious results.

Methods

To determine the site of hyper-reaction caused by alcohol in the Dextrostix system, 0.5 ml of isotonic saline sodium fluoride solution was used to block glucose oxidase activity, the first step of the system, and 0.5 ml of 1% hydrogen peroxide (first grade) then added to the tip of Dextrostix. Blood sugar measurements were performed by routine technique except for pretreatment with these agents. The effect of alcohol on dye was analysed using two other systems that also measure pure glucose using the same enzymes but different dyes. The tip of a Reflomat system (Yamanouchi Co, Japan), which contains propylcarbazol and toluidine as dye, and the Seralyzer system (Ames Co), which contains tri-methylbenzidine, were directly soaked and contaminated to 45% isopropyl alcohol. Fifty per cent isopropyl alcohol, 50% *N*-propanol, and 50% ethylalcohol, used in the analysis of other alcoholic agents to the Dextrostix system, were all of analytical reagent grade. 0.5ml Of artificially developed serum, packaged with Dextrostix Dextrometer system, was used as control serum.