

Saliva tests in the prognosis of caries in children

C.-G. CROSSNER & A.-K. HOLM

Department of Pedodontics, University of Umeå, Umeå, Sweden

Crossner, C.-G. & Holm, A.-K. Saliva tests in the prognosis of caries in children. *Acta Odont. Scand.* 35. 135-139

The purpose of the investigation was to find out whether the negative correlations between caries indices and the flow rate, pH and buffer effect of saliva that could be demonstrated in groups of 8- and 5-year-old children, were close enough to allow prediction of the development of caries in a given child. The results showed that the range of variation of the results of all analyses were very wide. This makes the use of saliva tests alone in the prognosis of caries development of less value in the individual child.

Key-words: Flow rate; buffer effect

Anna-Karin Holm, Department of Pedodontics, University of Umeå, Norrlandsgatan 18 B, S-902 48 Umeå, Sweden

The role played by the saliva in the resistance to caries has received much attention. In association with various diseases or medical treatment, profound changes in the chemical and physical properties of saliva may occur, which can result in a marked increase in the caries activity (Afonsky, 1961; Bertram, 1967; Mandel, 1974). As for the normal variation, Röse (1905) found a negative correlation between caries frequency and the buffer effect of saliva. This effect has since been confirmed in several investigations both in adults (Ericsson, 1959) and in children (Bergström *et al.*, 1960). A relationship between caries frequency and the flow rate and pH of saliva has also been found in adults (Ericsson, 1949; Ericsson *et al.*, 1954).

Owing to these correlations it has been recommended that saliva tests should be included as routine measures in the

investigation of patients with high caries activity. Recently, Andersson *et al.* (1974) reported normal values for the flow rate, pH and buffer effect of saliva in 5-, 6-, 7-, 8-, 10- and 13-year-old children, which now makes it possible to evaluate the results of such investigations of saliva also in children.

The children in the present investigation were subjected to extensive epidemiological studies (Holm, 1975; Crossner & Holm, 1975). These investigations revealed a negative correlation between caries indices and the above salivary factors. With the extension of the public dental health service these results have assumed greater interest, because they suggest that saliva tests may be of prognostic value in the early detection of children predisposed to high caries activity.

The purpose of this investigation was to find out whether the negative correlation between

caries indices and the flow rate, pH or buffer effect of saliva is close enough to allow prediction of the development of caries in a given child.

MATERIAL AND METHOD

The material consisted of 149 randomly selected healthy 8-year-old children (79 boys and 70 girls) and 178 healthy 5-year-old children (83 boys and 95 girls) living in the city of Umeå with mean ages of 8 years 4 months and 5 years 6 months, respectively. For further details see *Crossner & Holm (1975)* and *Holm (1975)*.

The children were examined for caries with the mirror and probe (type SSW No. 5) in good illumination and after adequate drying. The clinical examination was supplemented by radiography consisting of bite-wings of 88% of the 5-year-old children and of all the 8-year-old children. In the 8-year-old children the radiographic examination included occlusal views of the upper and lower front teeth. Caries was diagnosed in accordance with the criteria described by *Koch (1967)*. For the 8-year-old children only the caries indices of the primary dentition are accounted for because in this age there is a wide individual variation of both the number of permanent teeth and the time they have been erupted. The caries index used for the 8-year-old children has been described by *Gerdin (1966)* and is here called Gerdin's index. It can be used for the primary teeth in the mixed dentition and is well suited for regression analysis, since it can adopt all values between 0.00 and 1.00. For the 5-year-old children defs (decayed, extracted and filled primary surfaces) was used as caries index.

The flow rate, pH and buffer effect were measured in stimulated saliva. The sample was collected while the child was chewing a piece of paraffin (about 1 g) for five min and spitting out the saliva into a graduated cylinder. All samples were analysed immediately after collection. The rate of secretion was read in ml/min directly on the

graduated cylinder. pH was determined electrometrically with a glass electrode (*Andersson et al., 1974*), while the buffer effect was determined according to the method described by *Ericsson (1959)*. For further details, see *Andersson et al. (1974)*.

The statistical analysis was done with the aid of linear regression analyses (*Snedecor & Cochran, 1971*).

RESULTS

The flow rate and the buffer effect (Figs 1 and 3) were negatively correlated with Gerdin's index in the 8-year-old children ($P < 0.001$ and $P < 0.01$, respectively). No statistically significant correlation was found between the pH and Gerdin's index (Fig. 2). pH (Fig. 5) and the buffer effect (Fig. 6) were negatively correlated with defs in the 5-year-olds ($P < 0.01$), but no correlation was found between the flow rate and defs (Fig. 4). In all the analyses the individual scatter was, however, wide for both girls and boys in both age groups. No significant difference was found between the sexes regarding this scatter.

DISCUSSION

The results showed that also in children there is a negative correlation between the caries frequency and flow rate, pH and buffer effect of stimulated saliva. It has been assumed that these factors, at least to a certain extent, can be used for predicting the development of caries in a group of individuals. *Marlay (1970)*, for example, found a reduction in the buffer effect of saliva about 9 months before clinical caries was demonstrable.

In the present investigation, however, the range of variation of the results of all analyses was so wide that it could be assumed that the values could not be used for predicting the later development of caries in the individual child.

Several factors may have influenced the results in these samples. Thus, there is a normal diurnal variation which, among other factors, is affected by meals and sleep

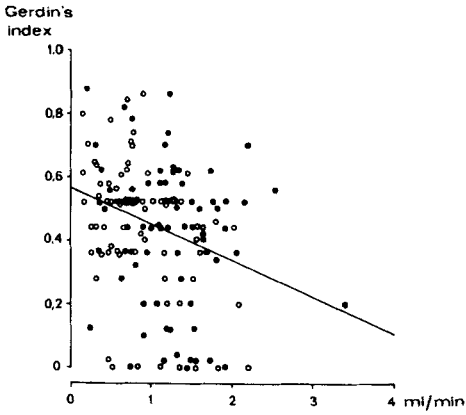


Fig. 1. Linear regression analysis between Gerdin's index and flow rate (ml/min) of stimulated saliva in 8-year-old children.

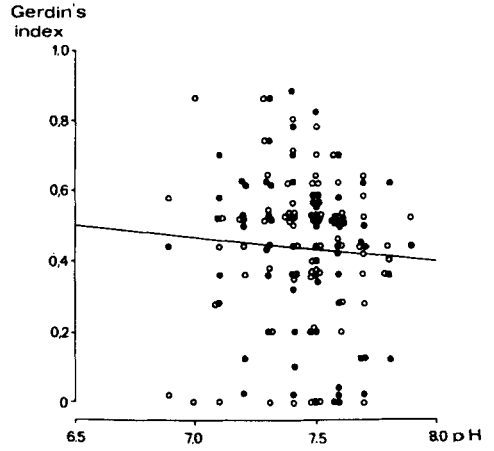


Fig. 2. Linear regression analysis between Gerdin's index and pH of stimulated saliva in 8-year-old children.

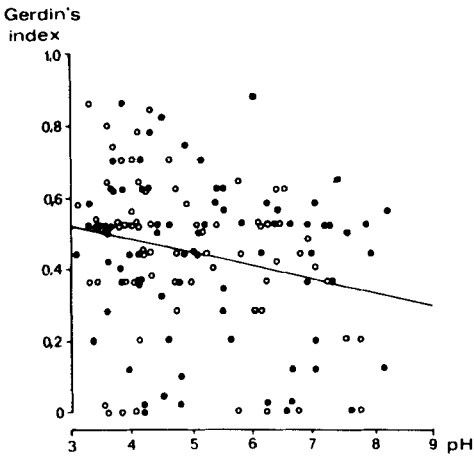


Fig. 3. Linear regression analysis between Gerdin's index and buffer effect (resulting pH) of stimulated saliva in 8-year-old children.

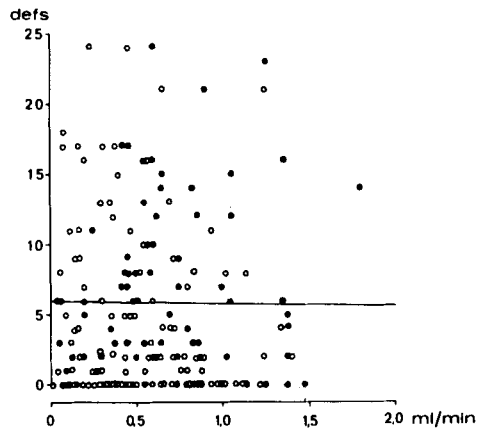


Fig. 4. Linear regression analysis between defs and flow rate (ml/min) of stimulated saliva in 5-year-old children.

(Ericsson, 1959). In addition, these salivary factors depend on the psychic tension of the individual during the collection of the saliva and on his general state of health (Code, 1967). The children were therefore given detailed and quietening information and instructions and the samples were collected under standardised conditions. All children and their parents were also given information that the child should not eat, drink or brush his teeth within the last few hours before sampling. If a

child showed signs of restlessness or disease on one sampling occasion, sampling was postponed until a later occasion.

As for the 5-year-olds, the data for flow rate must be regarded as minimal because the children may by mistake have swallowed a part of the saliva. This may also help to explain why no correlation was found between the flow rate and caries frequency in this age group. Misleading results because of less good cooperation need not, however, be

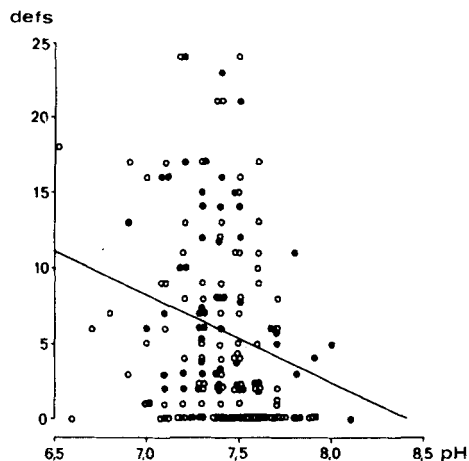


Fig. 5. Linear regression analysis between defs and pH of stimulated saliva in 5-year-old children.

feared in the 8-year-old group because double determinations made in corresponding age groups under the same conditions showed good agreement (Andersson *et al.*, 1974).

One observation which may help to explain the poor individual correlation is that an index of the caries frequency reflects the entire caries history of a patient. Therefore, the caries activity of the children might have been better related to the varying salivary conditions. This value was, however, not possible to obtain, as these children had not had dental treatment of their primary teeth.

The lack of agreement between caries indices and the flow rate, pH and buffer effect of saliva, respectively, in these children preclude the use of saliva tests alone in the prognosis of caries development in the individual child. This weakness of the test as a prophylactic instrument does not, however, exclude the use of the test in investigations of children with a high caries activity.

REFERENCES

- Afonsky, D. 1961. *Saliva and its relation to oral health*. A survey of the literature. University of Alabama Press, Alabama
- Andersson, R., Arvidsson, E., Crossner, C.-G., Holm, A.-K., Månsson, B. & Grahnén, H. 1974. The flow rate, pH and buffer effect of mixed saliva in children. *J. Int. Assoc. Dent. Child.* 5, 5-12

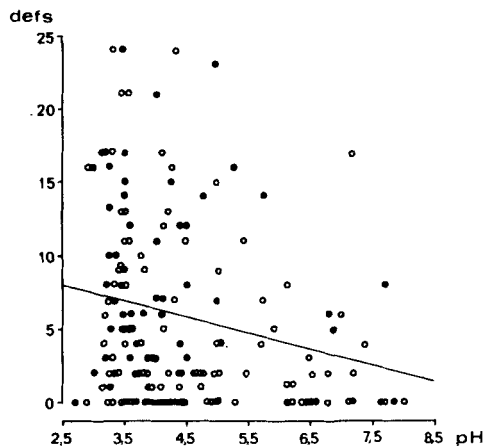


Fig. 6. Linear regression analysis between defs and buffer effect (resulting pH) of stimulated saliva in 5-year-old children.

- Bergström, K., Ericsson, Y. & Lysell, L. 1960. Kariesfria femåringar. *Sven. Tandläk. Tidskr.* 53, 599-610
- Bertram, U. 1967. *Xerostomia*. *Acta Odontol. Scand.* Vol. 25, Suppl. 49, Copenhagen
- Code, C.F. Ed. 1967. *Handbook of physiology*. Sect. 6, Vol. II, Amer. Phys. Soc., Washington
- Crossner, C.-G. & Holm, A.-K. 1975. A descriptive and comparative study of oral health in 8-year-old Swedish children. *Acta Odontol. Scand.* 33, 135-142
- Ericsson, Y. 1949. Enamel-apatite solubility. *Acta Odontol. Scand.* 8, Suppl. 3
- Ericsson, Y., Hellström, I., Jared, B. & Stjernström, L. 1954. Investigations into the relationship between saliva and dental caries. *Acta Odontol. Scand.* 11, 179-194
- Ericsson, Y. 1959. Clinical investigation of the salivary buffering action. *Acta Odontol. Scand.* 17, 131-165
- Gerdin, P.-O. 1966. Caries-indices for the mixed dentition. Thesis. Almqvist & Wiksell, Stockholm
- Holm, A.-K. 1975. Oral health in 5-year-old Swedish children. *Community Dent. Oral Epidemiol.* 3, 184-189
- Koch, G. 1967. Effect of sodium fluoride in dentifrice and mouthwash on incidence of dental caries in schoolchildren. *Odontol. Revy* 18, Suppl. 12
- Mandel, I.D. 1974. Relation of saliva and plaque to caries. *J. Dent. Res.* 53, 246-266
- Marlay, E. 1970. The relationship between dental caries and salivary properties at adolescence. *Aust. Dent. J.* 15, 412-422
- Röse, C. 1905. Zahnverderbnis und Speichelbeschaffenheit. *Dtsch. Monatsschr. Zahnheilkd.* 23, 705-746
- Snedecor, G.W. & Cochran, W.G. 1971. *Statistical methods*. The Iowa State University Press, Ames, Iowa, U.S.A.