HKU Faculty of Dentistry researcher helps predict children's risk of tooth decay

Results of a questionnaire, a mouth examination, and several biological tests can be used to estimate a child's risk of developing dental caries (tooth decay and cavities), according to a study conducted by Dr Xiao-li Gao from the HKU Faculty of Dentistry and colleagues from the National University of Singapore.

The researchers tested if the three investigations could be used as assessments to predict the likelihood of caries development 1 year later. They created five types of assessment and found that one of them, consisting of just a questionnaire, was simple but accurate enough for use in the community to find children who have the highest risk of caries.

Because having caries in primary (milk, temporary, baby, or deciduous) teeth is associated with caries development in secondary (adult or permanent) teeth, it is important to identify high-risk children and to offer treatment and preventive strategies, the researchers note. Hence, they randomly selected kindergartens in Singapore to test if three types of investigation could be developed into risk-assessment tools for children aged 3 to 6 years.

Firstly, parents completed a questionnaire on the child's background such as age; the parents' background such as educational level; the child's oral health habits including dental visits and bedtime snacks; the parents' report of their child's health problems; and parents' knowledge of and attitudes to oral health. Secondly, one dentist conducted a visual examination of each child's mouth, looking for dental plaque and caries. Thirdly, biological tests included measuring plaque acidity and bacteria in the saliva.

A total of 1782 children from 13 kindergartens took part in the study (889 boys and 893 girls, with an average age of 4.8 years). About 40% of the children had caries at the start of the study. One year later, about 44% of the 1576 children who were examined again were found to have developed new caries. Although 62 (3.5%) of the children had visited a dentist during the year, the researchers considered this to have a negligible effect on the rest of the study.

Statistical analyses on data from half of the children, chosen at random, revealed that some factors were associated with an increased likelihood of developing caries within 1 year — for example, bedtime snacks, having caries at the start of the study, and bacterial levels in the saliva. Some factors were associated with a reduced likelihood — for example, a father's educational level, use of fluoride other than in toothpaste, and less plaque acid. In addition, having parents who believed that caries is caused by "tooth worms" seemed to be a protective factor against caries, leading the authors to suggest that the image of worms "with creative modifications…might be useful in oral health education" among children.

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The researchers then examined the power of five different combinations of investigations in predicting a child's risk of caries within 1 year. Two of the assessment models were "Prediction" models that measured all factors relevant to caries development and two were simpler "Risk" models that measured only preventive factors that could in theory be changed so as to lower caries risk. Both types of model were based on the questionnaire and mouth examination, and each had an expensive version and a cheap version, depending on whether biological screening tests were added.

Using data from the remaining half of the children, the researchers found that adding the results of biological tests increased the accuracy of risk assessment. The sensitivity/specificity of the "Prediction" model was 82%/73% without the biological tests and 90%/90% with them; the sensitivity/specificity of the "Risk" model was 81%/62% without the biological tests and 83%/92% with them.

The fifth assessment tool, which was only a questionnaire of six questions, was the cheapest and simplest method, and was designed as a community-based screening tool to identify the 25% of children with the highest risk of caries. The sensitivity/specificity of this "Community-screening" model was 82%/81%, which was higher than that of an existing Swedish computer-based assessment called Cariogram (71%/66%).

The different assessment methods developed in this study meet different screening requirements in the community or clinic, the authors conclude. In particular, the "Community-screening" tool was judged as being accurate enough and practical for early detection and treatment of caries among kindergarten children, "especially in communities where regular dental screening for preschoolers is uncommon and/or costly".

The study was published in 2010 in the *Journal of Dental Research*, which is owned by the International Association for Dental Research (IADR) and the American Association for Dental Research (AADR). In March 2011, the two organisations announced that this article was the best piece of clinical research in their journal in 2010 and awarded Dr Xiao-li Gao and her co-authors with the 2011 IADR/AADR William J Gies Award for Clinical Research. Dr Gao is now adapting the assessment tools for use in Hong Kong.

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