Psychology

Microbiota-based Approach for Predicting Early Childhood Caries

Microbiota are present everywhere in the biosphere. Can they be used as indigenous "biosensors" to diagnose and predict the health of their ecosystems? Recently, a joint research team from the Single-Cell Center, Qingdao Institute of Bioenergy and Bioprocess Technology (QIBEBT), Chinese Academy of Sciences and Guanghua School and Hospital of Stomatology, Sun Yat-sen University (SYSU) has developed a microbiota-based approach to predict early childhood caries.

Dental caries has been a worldwide health concern, affecting humans of all ages and incurring enormous societal costs. Early childhood caries (ECC), the most common oral disease in children, inflicts approximately 60-90% of children worldwide. ECC leads to sustained demineralization of enamel and dentin, and the infection can spread from the affected tooth to the surrounding soft tissues, resulting in swelling and inflammation in highly progressed cases. Once started, the damage to teeth is irreversible, with child patients continuing to suffer from a higher risk for new lesions and even tooth loss over their entire lifespan. Therefore, preventive intervention of ECC is of particular clinical significance.

Graduate student TENG Fei and her colleagues simultaneously tracked microbiota development at plaque and saliva in 50 four-year-old preschoolers for two years, who either stayed healthy, transitioned into cariogenesis or experienced caries exacerbation. They found that caries onset delayed microbiota development which otherwise are correlated with aging in healthy children. By distinguishing between aging- and disease-associated taxa and exploiting the distinct microbiota dynamics between onset and progression, they proposed a novel Microbial Indicators of Caries (MiC), which can predict future ECC onsets for samples clinically perceived as healthy with 81% accuracy.

Comparing with traditional caries risk assessment methods such as oral bacteria count, chemical characteristics of saliva, baseline caries status, as well as personal questionnaires (e.g. oral hygiene), MiC is objective and independent upon the human examiner's visual observation, individual judgment and microbial culture, leading to satisfactory reproducibility and comparability among examiners.

Furthermore, the study revealed that, in healthy children, oral microbial composition is age-dependent, that is "Oral Microbiota Ages" of healthy children were consistent with their corresponding chronological ages. However, in caries onset and progression children, their "Oral Microbiota Ages" were derailed from their corresponding chronological ages. Thus "Oral Microbiota Age" can serve as a population-wide, early alarm system for predicting ECC risks.

Human health and nutrition are closely linked to their microbial symbionts, collectively called the Second Human Genome. Diagnosis and prediction of chronic diseases based on human microbiota has been drawing significant attentions, yet only a few cases have been published so far. Therefore, the findings in this study may be of reference value to those studying the microbiota inhabiting other body sites of human and the microbiota in the ocean, soil and air.

The research was led by Prof. XU Jian, Director of QIBEBT's Single-Cell Center and Prof. LING Junqi, Guanghua School and Hospital of Stomatology, Sun Yat-sen University. Prof. Rob KNIGHT's team from the University of California San Diego and researchers from Qingdao Municipal Hospital also participated in this study.

Their paper has been published in *Cell Host & Microbe*.

Microbiota-based prediction of caries onset in children.