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EDITORIAL

Advances in breath odor research: re-evaluation and newly-arising sciences

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The articles in this special section describe the most recent advances in halitosis research presented at the Ninth International Conference on Breath Odor Research, a joint conference with the XXIV CONBRAPE (Brazilian Congress of Periodontology) held at Bahia Othon Palace Hotel in Salvador, Bahia, Brazil on 25–28 May 2011. It has been almost half a century since Joseph Tonzetich of the Faculty of Dentistry at the University of British Columbia, Vancouver, Canada (the first honorable member of the International Society for Breath Odor Research (ISBOR) who died in 2000, and is known as ‘the godfather of halitosis research’) published his first halitosis paper entitled ‘Evaluation of volatile odoriferous components of saliva’ in *Archives of Oral Biology* in 1964 [1]. This was the starting point for breath-odor research, long before ISBOR was established, although research in this area had declined by the time we convened global collaboration in halitosis research.

One must ask the question; what progress have we made during the past half-century? Although a few bad-breath detectors have appeared on the market, organoleptic scoring is still likely to remain as the ‘gold standard’. In the 21st century, people in modern dentistry or medicine are still sniffing their patients’ breath in order to diagnose halitosis, a very subjective method! Halitosis is widely believed to be simple to diagnose and treat, but this is certainly not the case, considering we have not yet even completed an objective detection measurement protocol for oral malodor.

In the treatment of halitosis, for many years before Tonzetich came into the field, tongue coating had been suspected to be the main cause, and this was scientifically proven a quarter of a century ago. However, people still visually and subjectively measure the amount of tongue coating to diagnose halitosis and an objective and more accurate method is required and needs to be developed. Those of us that work in this field employ mainly subjective protocols for diagnosis, but scientists are well aware that the data obtained by subjective procedures are not universal and therefore it is not possible to compare data obtained by a subjective measure with data from a different paper. It has been suggested that our procedures in halitosis clinics are not scientific and are almost the same as they were hundreds of years ago. Why have we not made progress in these fundamental measures for halitosis clinics? Everybody involved in halitosis clinics or the related sciences should ask themselves this question.

Removing tongue coating (TC), which consists mostly of bacteria and exfoliated keratinized epithelial cells, is a radical remedy and is considered as the most effective way to treat halitosis. For many years, people employed mechanical tongue-cleaning methods, such as using a tongue scraper. In the early 1970s it was reported that mechanical stimulation promotes tongue cancer [2]. This hypothesis may not be absolutely correct, since most tongue cancers are found on the side (lateral margin) of middle third of the tongue, and so the relationship between tongue scraping and cancer has not yet been confirmed. However, there is still a possibility that mechanical stimulation is one of the causes of tongue cancer. To effectively and safely remove tongue coating there is no doubt that we must develop a novel technology without using mechanical...
stimulation, but no such research efforts have yet been reported since the early 1970s.

The protocols for halitosis clinical research can be divided into two sub-classifications: short-term and long-term. For both groups, subjects must abstain from ingestion of food, drinking and oral hygiene for four hours prior to evaluation of oral malodor, as described in [3], since this is the best time to measure volatile sulfur compounds (VSCs), as defined by the ADA guidelines. A recent paper has suggested that this protocol might not be correct, since eating and oral hygiene may affect VSCs in mouth air for longer than four hours after these activities [4]. In long-term studies, three weeks’ intervention is recommended by the ADA, during which time they measure malodor strength or VSC concentration at the baseline each day. The premise of this protocol is that the baseline of VSC concentration or malodor strength is constant over certain days, but there are those who doubt that the baseline is consistent.

The organoleptic procedure is perceived as the gold standard for diagnosing oral malodor; however, for clinical work on halitosis, not only detection but also quantification is required. Organoleptic measurements do not require purpose-built apparatus, which explains why this has been a popular method among clinicians. But there are many drawbacks to this type of diagnosis. Quantification of odor sensations is very difficult, and the most difficult feature of the organoleptic procedures is stimulus presentation, while objective measurements directly determine the concentration of stimulus. Therefore, halitosis detectors should be the method of choice for clinicians.

A number of halitosis detectors have been used in the past 30 years. The portable sulfide monitor was very popular, but it also reacts with other compounds which cannot be accurately detected. Recently, portable gas chromatographs (GCs) were introduced, but this exciting technology could only report a few evaluations. Even using portable or regular GCs, the ADA recommends that their protocols be employed in clinical research.

The papers selected for this special section provide some answers to the above questions or demonstrate a novel aspect of halitosis pathology. Moreover, they illustrate the diversity of approaches to the pathological and physiological activities of VSCs. It is a challenging field.

The main challenges, as noted by K Yeagaki et al [5], are that problems have been identified in current, widely-used protocols. (1) The baselines of VSC concentrations in mouth air varied considerably over the course of a week. (2) When subjects refrained from eating, drinking and oral hygiene, including mouth rinsing, the VSC concentrations remained constant until the subject began eating again. (3) Over a six-hour period after a meal and oral hygiene, VSC concentrations decreased significantly. The above data point to optimal times and conditions for sampling subjects. Yeagaki et al also compared measurements obtained using several portable devices with measurements obtained using GCs, showing that portable devices demonstrate capabilities similar to those of GCs. Thus, a recommended protocol has been established. The proposed protocol includes the following recommendations: (a) a short-term rather than long-term study is strongly recommended, since VSC concentrations are constant in the short term; (b) a crossover study would best avoid the effects of individual specificities on each clinical intervention; and (c) measurements of VSCs should preferably be carried out using either a GC or a portable GC.

To control VSC production, removing the TC is essential for the maintenance of oral hygiene and tongue-brushing or a scraper is utilized for this purpose. Mechanical stimulation needs to be eliminated as much as possible for the reasons mentioned above or to avoid unpleasant side effects. Nohno et al [6] have developed candy tablets containing a protease, actinidine, and effect of long-term use of these on both TC accumulation and the concentration of VSCs in mouth air has been determined. This is a novel procedure that removes the TC safely.
Although most researchers and clinicians evaluate TC accumulation subjectively and visually, this is neither scientific nor objective. Nohno et al have also demonstrated an objective method of evaluating TC using a digital camera and the software ImageJ (NIH, USA). Moreover, they suggest that a long-term research design might not be appropriate. To develop new halitosis sciences, ISBOR would never to nip new knowledge in the bud—we should nurture such a promising young bud.

Tangerman et al [7] found no association between halitosis and *H. pylori* infection of the stomach, although *H. pylori* is believed to be a cause of extra-oral pathologic halitosis. Suzuki et al [8] found that the use of probiotics, a now popular way for controlling oral malodor, is effective in reducing TC accumulation, but they also described its limitations. Determining the limitations of a remedy is essential for both clinicians and patients. We must encourage the adoption of such a presentation style as demonstrated by Suzuki et al among breath-odor clinical scientists or clinicians.

Possible chemosensory dysfunction can elicit halitosis complaints. Falcão et al [9] found that chemosensory dysfunction may cause pseudo-halitosis that proves very difficult to treat.

Aoyama et al [10] reviewed the role of p53 in the apoptosis of periodontal tissues caused by oral malodorous compounds, and emphasized its toxicity. This information could be very useful in enabling people to prevent halitosis. Ishkitiev et al [11] established the protocol for differentiation of human dental pulp stem cells to hepatic cells, and found that hydrogen sulfide increases hepatic differentiation. This is a positive effect of oral malodorous compounds. However, they still need to establish universally accepted standards for evaluating the toxicity or positive effects of VSCs as shown in their report, since those topics are not yet well understood among halitosis scientists.

I would like to emphasise that this editorial represents only my own views on some of the most interesting findings in halitosis research. However, I must stress again that it is time to re-evaluate the halitosis clinical sciences, and to invest in the newly-arising sciences of halitosis. We look forward to our next ISBOR conference in two years’ time.

References