

Digital technology increases efficacy of caries assessment

Professor Anahita Jablonski-Momeni, a leading cariologist at the Philipps-University of Marburg, Germany, discusses her award-winning study¹ on the identification of active caries using the latest bioluminescent technology.

Introduction:

Dental caries in permanent teeth is one of the most widespread diseases in the world, with an estimated 36 per cent of the population affected to some degree.² If ignored, the ramifications of this disease can become quite serious, including the loss of teeth, the formation of abscesses and even the development of periodontal disease. Frustratingly, however, dental caries can easily be prevented with early intervention. Indeed, in its initial stages, the effects of caries can be wholly reversed with the utilisation of remineralisation therapies – like fluoride treatments.

As such, it is important for dental professionals to be able to identify active caries as early as possible, in order for them to take preventive action before cavitation becomes irreversible.

Current methods of determining the activity of carious lesions rely heavily on visual analysis and subjective assessment – as yet, there is no widely accepted objective method of mapping the initial progress of demineralisation. This has led to widespread under-treatment of active lesions or, conversely, the unnecessary treatment of inactive lesions.

However, new digital technologies are emerging that aim to provide dental practitioners with an early detection system that can be used on patients in the dental surgery. The results collected through these systems can be accessed instantaneously and reviewed to determine what course of action should be taken in order to preserve as much of the natural tooth structure as possible.

Thus, the following study was undertaken in order to ascertain the efficacy of an innovative digital technology compared to established manual methods used in dental surgeries around the world.

Methodology:

A sample of 46 recently extracted posterior teeth were used for this study, all of which were assessed *in vitro* in order to identify an adequate investigation site. Only teeth that exhibited initial or moderate carious lesions were used – teeth with obvious dentine caries or extreme levels of decay were excluded to emulate the need to identify caries in its earliest – and ultimately reversible – stage.

In order to identify a reliable reference point, a number of established visual criteria were used to determine whether active lesions were present. These were the NYVAD and International Caries Detection and Assessment System (ICDAS) methods, which are among the most accepted, non-histological methods of identifying the extent and activity of caries lesions.

Of the 46 teeth examined using the NYVAD and ICDAS methods, 41 exhibited signs of active lesions and five were inactive. These results were then used as the control against which the new digital technology could be tested. The innovative new digital technology used in the study was the CALCIVIS Caries Activity Imaging System³. This handheld device utilises a specific photoprotein that, on contact with free calcium ions, creates a bioluminescent signal that is captured by an integrated camera. The images can then be used to assess caries activity on a tooth's surface and presented chair-side to inform and motivate patient acceptance of subsequent preventive or operative treatments.

Results:

Compared to the NYVAD and ICDAS criteria, the CALCIVIS imaging system performed very favourably. Indeed, the kappa values for the agreement of the findings with regard to lesion activity compared to CALCIVIS imaging system were: NYVAD-CALCIVIS = 0.78 and ICDAS-CALCIVIS = 1.0.

Conclusions:

Examples of the visual-tactile methods for identifying active caries, such as the NYVAD and ICDAS methods, are, while effective, unsuited to providing the kind of objective and digitised data that is prevalent in other areas of dentistry. The adoption of digital technology is a significant step forward in terms of caries activity assessment and has the potential to increase the efficacy of preventive treatment. On the basis of this study, the CALCIVIS imaging system provided promising results and a strong correlation with the established methods of caries activity identification.

The benefits of such technology might also enhance a dental practitioner's ability to monitor specific lesions over time and better inform their decision to commit to treatment. As in other areas of 'digital dentistry', the ability to document and present this information can also be used to enhance patients' understanding of their own oral health issues – and promote greater compliance with early stage preventive care.

For more information visit www.calcivis.com or call 0131 658 5152.

About the study author: *Professor Anahita Jablonski-Momeni is a senior lecturer and Associate Professor at the Philipps-University of Marburg. She is a member of the advisory board at the European Organisation of Caries Research (ORCA) and has been internationally recognised for her work on caries detection, caries activity assessment and remineralisation and regeneration of tooth tissues.*

¹ A. Jablonski-Momeni and L. Kneib, *Assessment of Caries Activity Using the CALCIVIS® Caries Activity Imaging System: The Open Access Journal of Science and Technology*. Vol. 4 (2016) Link: <http://www.agialpress.com/journals/oajost/2016/101241/#B1>

² W. Marcenes, N. J. Kassebaum, E. Bernabé, A. Flaxman, M. Naghavi, A. Lopez, and C. J. Murray, *Global burden of oral conditions in 1990-2010: a systematic analysis*, *J Dent Res*, 92, 592-597, (2013)

³ Commercial name: CALCIVIS imaging system replaces CALCIVIS Caries Activity Imaging System in future references.

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Graphics of the author and CALCIVIS imaging system will accompany this piece.