

# Summary of: Evaluation of *in vivo* denture plaque assessment methods

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## FULL PAPER DETAILS

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**Background** Measurement and assessment of denture plaque can provide valuable information regarding an individual's oral health status and assessment of new treatments or products. Current methods tend to rely on subjective indices or image analysis derived planimetric (area measurement) assessment of stained plaque on dentures. Plaque indices are most commonly used to assess plaque coverage without image capture. This is not ideal because the methods are subjective, examiner bias may occur, there is no reproducibility between studies, the methods have lower accuracy and sensitivity than image analysis, and there is no record. To the authors' knowledge, no standardised published method of denture plaque assessment is currently employed for product development and testing. **Method** In this study visual and planimetric plaque assessment methods were compared using reference dentures. In addition, an *in vivo* study compared these methods for evaluating denture cleanser efficacy. **Results and conclusions** The results show that blinded image scoring is more representative of the true plaque area coverage than 'live' denture scoring, detecting significant decreases in plaque coverage. Planimetric analysis provides a more sensitive and less subjective technique with greater differentiation between treatments. However, analysis is very time consuming. Thus, a number of recommendations are made regarding quantification of denture plaque for the assessment of cleanser products.

## EDITOR'S SUMMARY

In the UK in particular, but in many others countries of the western world, the overall need for the provision of dentures has fallen dramatically in recent years. Although, as a result of the fall in caries leading to greater tooth retention for longer, the construction of full dentures has dropped markedly the same changes in disease patterns have meant a rise in the need for partial dentures. When the effect of an increasing number of implants being placed is added to the equation, with some cases also requiring overdentures, the result is that the need for removable prosthodontics will remain for the foreseeable future in some form or another.

Tooth loss is a prerequisite of the need for dentures and this is primarily due to either caries or periodontal disease, both of which are of course preventable. But secondary prevention is also

crucially important for such patients, who are arguably at greater risk than others given their oral health history. Needless to say this will involve oral hygiene education in some form or another.

It is therefore all the more important to establish a measurable system to quantify plaque growth on dentures since without such an objective measure it is not possible to track any changes in improved, or deteriorating, oral hygiene practices. Importantly, the standards also mean that patients will be able to monitor their progress in an objective way in much the same way as fully dentate patients do with plaque indices.

This paper provides such a starting point, although as with much research coming to light one wonders that this hasn't been achieved before. In the field of further research, both experimentally and in terms of new product

development, a measure that gives the security of comparability is also to be welcomed and applauded.

The full paper can be accessed from the *BDJ* website ([www.bdj.co.uk](http://www.bdj.co.uk)), under 'Research' in the table of contents for Volume 207 issue 6.

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Editor-in-Chief

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**IN BRIEF**

- Provides a critical review of methods used to assess coverage of denture surfaces by plaque.
- Notes that there is no current standardised method.
- Considers the relative merits of planimetric and visual indices.
- Recommends the maintenance of an image library as a record of data, and blinded visual scoring from images as current best practice.

**COMMENT**

Oral health is directly related to the quality of life, impacting the functional ability of an individual to eat and speak, as well as influencing their aesthetics and appearance. Because oral health declines with age, diseases of the oral cavity frequently result in tooth loss. Removable or fixed prostheses serve as replacements for natural teeth and for the denture wearer, maintaining good oral hygiene is very important. Recent reports suggest a correlation between the hygienic condition of the denture and the general and systemic health of the individual.

The oral microflora is composed of a diverse group of microorganisms including 700 different types of bacteria, as well as fungi, protozoa and viruses. Denture plaque is a community of microorganisms encapsulated within a matrix of exopolymeric material attached to different substrates. Plaque is difficult to disrupt and is generally antimicrobial resistant. Denture plaque develops from the adherence, aggregation and growth of microorganisms in the absence of appropriate denture hygiene. For the denture wearer, complex microbial manifestations can ultimately result in the initiation of respiratory disease, adversely affect systemic health and contribute to malnutrition in denture wearers.

*In vitro* and *in vivo* methods have been described for evaluating denture plaque. *In vitro* approaches often utilize common food stains as plaque models that are then quantified by a reflectometer. This paper by Coulthwaite and Verran investigated different *in*

*vivo* approaches for assessing denture plaque. Visual and planimetric plaque assessment methods were compared using reference dentures. The authors evaluated the two methods by performing an *in vivo* study designed to assess efficacies of denture cleansers. Although the planimetric analysis demonstrated a more sensitive, less subjective approach, data analysis was found to be time consuming. Given the importance of controlling denture plaque and its relationship to overall health, it would be of interest to expand the current study to include confocal laser scanning microscopy with a vitality staining technique (fluorescence). A second study of interest would be to investigate the correlation between *in vitro* and *in vivo* methodologies as an approach for determining the predictive strength of *in vitro* methodologies.

For the denture wearer, it is imperative to clean their appliance with an appropriate cleanser. Non-abrasive formulations optimized for denture substrate materials are recommended. The study reported by Coulthwaite and Verran has advanced our knowledge with respect to the system requirements for *in vivo* plaque quantification. The conclusions in this study stress the need for the creation of standards for plaque assessment determinations, and a system that allows for archiving of images. Continued technological advancements will enable accurate, precise and spatial analyses of denture plaque.

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**AUTHOR QUESTIONS AND ANSWERS****1. Why did you undertake this research?**

In our laboratories, we have investigated the role of *Candida albicans* in denture-associated stomatitis for some years. More recently, we have focused on the characterisation of denture plaque and properties of plaque from the denture fitting surface compared with that of the labial/lingual surfaces, and on the significance of denture plaque as a reservoir for other opportunist pathogens. An assessment of the effectiveness of denture hygiene procedures and products was part of this work. Using quantitative light-induced fluorescence (QLF), we were able to demonstrate the presence of obligate anaerobic species in mature plaque (red fluorescence). The overall aim was to evaluate the potential of QLF as an objective tool for quantitative as well as qualitative characterisation of denture plaque. Prior to this, a comparison of existing methods, as described in this paper, was necessary.

**2. What would you like to do next in this area to follow on from this work?**

Results of this study have revealed the best method by which to proceed. In separate studies, we showed that QLF was not useful for denture plaque assessment, due to the differential and unpredictable fluorescence of denture acrylic and the excessive time required to obtain appropriate images. Future work will focus on the development of planimetric analyses that can be obtained from image libraries in a short time period. This capitalises on the advantages of planimetry, and addresses limitations.