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J Dent. 2015 Aug;43(8):955-64. doi: 10.1016/j.jdent.2015.06.003. Epub 2015 Jun 22.

A novel colourimetric technique to assess chewing function using two-coloured specimens: Validation and application

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PMID: 26111925 DOI: 10.1016/j.jdent.2015.06.003

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Abstract

Objectives: Chewing efficiency may be evaluated using cohesive specimen, especially in elderly or dysphagic patients. The aim of this study was to evaluate three two-coloured chewing gums for a colour-mixing ability test and to validate a new purpose built software (ViewGum©).

Methods: Dentate participants (dentate-group) and edentulous patients with mandibular two-implant overdentures (IOD-group) were recruited. First, the dentate-group chewed three different types of two-coloured gum (gum1-gum3) for 5, 10, 20, 30 and 50 chewing cycles. Subsequently the number of chewing cycles with the highest intra- and inter-rater agreement was determined visually by applying a scale (SA) and opto-electronically (ViewGum©, Bland-Altman analysis). The ViewGum© software determines semi-automatically the variance of hue (VOH); inadequate mixing presents with larger VOH than complete mixing. Secondly, the dentate-group and the IOD-group were compared.

Results: The dentate-group comprised 20 participants (10 female, 30.3±6.7 years); the IOD-group 15 participants (10 female, 74.6±8.3 years). Intra-rater and inter-rater agreement (SA) was very high at 20 chewing cycles (95.00-98.75%). Gums 1-3 showed different colour-mixing characteristics as a function of chewing cycles, gum1 showed a logarithmic association; gum2 and gum3 demonstrated more linear behaviours. However, the number of chewing cycles could be predicted in all specimens from VOH (all $p<0.0001$, mixed linear regression models). Both analyses proved discriminative to the dental state.

Conclusion: ViewGum© proved to be a reliable and discriminative tool to opto-electronically assess chewing efficiency, given an elastic specimen is chewed for 20 cycles and could be recommended for the evaluation of chewing efficiency in a clinical and research setting.

Clinical significance: Chewing is a complex function of the oro-facial structures and the central nervous system. The application of the proposed assessments of the chewing function in geriatrics or special care dentistry could help visualising oro-functional or dental comorbidities in dysphagic patients or those suffering from protein-energy malnutrition.

Keywords: Chewing gum; Edentulous mouth; Mastication; Symptom assessment.

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