

**Rapporteurs:**

Anastasiya Orishko, Marwa Albulushi, Mohammed Alqarzaee, and Nikita Patel, with Prof Francesco D'Aiuto

**Affiliation:**

Postgraduate programme in periodontology, UCL Eastman Dental Institute, London, UK

*study*

# Mastication in patients with periodontitis

**Authors:**

Anna Greta Barbe, Simin Javadian, Thea Rott, Isabel Scharfenberg, Helena Caterina Deborah Deutscher, Michael Johannes Noack, and Sonja Henny Maria Derman

## Background

Untreated periodontitis leads to progressive tooth loss which has consequences for masticatory function. Recent studies have suggested lower activity of some masticatory muscles and reduced bite force in patients with periodontitis. Others have found an association between masticatory function and general health, affecting heart rate, blood flow, and brain function. Poor mastication may result in a reduced intake of fruit and vegetables, leading to malnutrition.

When treating periodontitis patients, masticatory function might be one of the important parameters to consider. It has recently been incorporated into the classification of periodontitis as a complexity factor that defines a need for complex rehabilitation. As masticatory function has a significant impact on patients' quality of life, it seems reasonable to investigate patient-reported outcomes, as well as disease-centred parameters, to be able to make specific therapy recommendations.

To explore masticatory function, a combination of objective and subjective evaluation is recommended. Masticatory ability is the *subjective* assessment of masticatory function by the patient, evaluated using interviews or special questionnaires such as the Quality of Masticatory Function questionnaire (QMF). Masticatory efficiency is the *objective* assessment, defined as "the effort required to achieve a standardised degree of comminution" (e.g., HueCheck Gum – analysis of the colour mixing of two differently coloured chewing gums).

## Aims

The aim of this pilot, cross-sectional study was to examine patient-centred clinical outcomes for objective masticatory efficiency (OME) and the subjective quality of masticatory function (QMF) among periodontitis patients undergoing supportive periodontal therapy.

## Materials & methods

- This cross-sectional pilot study included 224 patients undergoing supportive periodontal therapy with biannual recall.
- All examinations were performed by fourth-year undergraduate dental students, who had practical calibration sessions. Periodontal clinical parameters recorded were: probing pocket depth (PPD), clinical attachment level (CAL), bleeding on probing (BoP), Quigley-Hein Index (QHI), and tooth mobility.
- **Objective assessment of masticatory efficiency (HueCheck Gum)**, based on analysis of the colour mixing of blue and pink chewing gum.
  - Two dragée-form gums were stuck together manually after wetting them with water. The gums were positioned on the patient's tongue. Patients were asked to perform 20 chewing cycles with no time limit, advised to chew "as usual as possible", and were allowed to change chewing sides.
  - The gum was retrieved and sent for analysis.
  - Chewing function was evaluated through optoelectronic analysis using ViewGum software and gums were scanned at both sides.
  - Following transformation into the HSI colour space, the variance of hue (VOH) was calculated by the software.
  - VOH is considered a measure of masticatory performance because of its association with the number of chewing cycles. High VOH values result from poorly mixed colour while adequate chewing leads to well-mixed colours and therefore low VOH values.
- **Subjective quality of masticatory function** was assessed with the QMF questionnaire, which consisted of 29 questions related to frequency and difficulty of chewing different types of foods in the previous two weeks.
- **Quality of functional occlusal units (OUs)** was defined as one pair of occluding natural, restored, or fixed prosthetic posterior/post-canine teeth.

Figure		Stage I	Stage II	Stage III	Stage IV
	<p>Graphical representation of the associations between objective masticatory efficiency and quality of masticatory function and the clinical examination parameters related to the stage according to the new periodontitis classification. Correlations according to Pearson's with statistical significance (<math>p &lt; .05</math>) appear green, with a statistical trend yellow (<math>p = .05-.08</math>) and non-significant correlations (<math>p &gt; .08</math>) red.</p>	<b>OBJECTIVE MASTICATORY EFFICIENCY</b>			
Number of teeth		Green	Green	Green	Red
Plaque-control ability		Red	Green	Red	Red
Probing depth		Red	Green	Red	Red
Clinical attachment level		Red	Green	Yellow	Red
Tooth mobility		Red	Green	Red	Red
Functional occlusal units		Green	Green	Green	Red
Gingival inflammation		Red	Red	Red	Red
<b>QUALITY OF MASTICATORY FUNCTION</b>					
Number of teeth		Red	Red	Red	Red
Plaque-control ability		Red	Red	Yellow	Red
Probing depth		Red	Red	Red	Red
Clinical attachment level		Red	Red	Red	Green
Tooth mobility		Red	Red	Red	Red
Functional occlusal units		Red	Red	Red	Red
Gingival inflammation		Red	Red	Red	Red

## Results

- A total of 224 patients on supportive periodontal care (SPC) with a mean of 10 SPC appointments were examined. The participants had a mean QHI of  $1.4 \pm 1.7$ . The mean PPD was  $2.5 \pm 0.5$ mm, mean BoP  $10.7 \pm 9.8\%$ , and mean attachment level  $4.2 \pm 1.2$ mm.
- Stage IV periodontitis showed a slightly higher value for OME (0.2) compared to stages I, II, and III (0.1). It also showed the highest value for QMF ( $35.3 \pm 26.9$ ) compared to stage I ( $26.7 \pm 24.1$ ), stage II ( $26.6 \pm 17$ ) and stage III ( $19.6 \pm 10.6$ ).
- There was a significant correlation between OME and QMF.
- Correlation analysis showed significant correlations between OME and number of teeth, oral hygiene, mean attachment level, mean probing depth, maximum tooth mobility, and functional OUs, with no noted correlation with BoP. The highest reported correlation was noted with OUs (0.423).
- Most of the correlations appeared in stage II periodontitis, whereas in stage IV none of the parameters collected was associated with OME.
- QMF showed a correlation only with the number of teeth and functional OUs with no noted correlation with all periodontal parameters.
- Regression analysis showed that the number of OUs influenced the OME ( $p=0.012$ ), while QMF was influenced by PPD ( $p=0.045$ ) and stage of periodontitis ( $p=0.013$ ).

## Limitations

- No calibration values were presented for the student examiners.
- Periodontal diagnosis was documented according to the 1999 classification and the new (2018) classification was applied and investigated retrospectively.
- It could be useful to know the number of patients with BoP percentage  $\geq 10\%$  and PPD of  $\geq 4$  mm with BoP to highlight unstable periodontitis patients (Chapple et al., 2018).
- Masticatory dysfunction is one of the factors that defines the need for complex rehabilitation (Papapanou et al., 2018). It is not clearly defined whether patients have already undergone restorative rehabilitation, the type of prostheses patients had, and whether any were removed during the QMF test.
- There is limited data on clearly defined variance of hue (VOH) values to measure adequate chewing performance.

## Conclusions / Impact

- Among periodontitis patients, OME and QMF were associated with each other.
- Stage IV periodontitis had the highest values for both test methods.
- Clinical periodontal parameters except BoP influenced OME, particularly in stage II.
- The number of teeth and OUs are associated with QMF while periodontal parameters did not show associations.
- The study showed that OME and QMF are promising parameters to assess masticatory function in patients with periodontitis. However, a direct clinical implication cannot be concluded.

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