

Validity of periodontal pocketing in the detection of periodontitis – a diagnostic accuracy study

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Background

According to the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions, a patient is defined as a periodontitis case when presenting with interdental clinical attachment loss at ≥ 2 non-adjacent teeth or with buccal clinical attachment loss of at least 3 mm coinciding with periodontal pocketing > 3 mm at ≥ 2 teeth (Tonetti, Greenwell, & Kornman, 2018).

Consequently, the case definition requires the evaluation of clinical attachment levels and/or radiographic marginal bone levels. Such assessments, however, may be impractical in large epidemiological surveys and potentially impossible in registry studies. As an alternative, probing depth (PD) based on partial- or full-mouth recordings has been used as a proxy for clinical attachment loss and, thereby, periodontitis in epidemiological studies. For instance, 50 of the 72 studies included in a highly cited systematic review on the global burden of severe periodontitis (Kassebaum et al., 2014), based their case definitions on PD alone (either PD > 5 mm or Community Periodontal Index of Treatment Needs, CPITN, class 4).

The use of PD alone for epidemiological research remains a point of contention among researchers in the field. By definition, clinical attachment loss represents current and/or past disease experience, whilst PD is a measure of current disease. Several papers in the 80s-90s highlighted the limitations of CPITN (based on bleeding on probing, presence of calculus and PD) in epidemiological research. The criticism focused mainly on the use of partial-mouth registrations and the potentially low validity of lower scores of the index, but also on whether it actually provided accurate estimates of prevalence/severity of periodontitis (see for instance Baelum & Papapanou, 1996). Interestingly, the use of deep periodontal probing (≥ 1 tooth with PD ≥ 6 mm) was recently reported to have a high diagnostic accuracy in detecting severe periodontitis as per the 2017 case definition and classification (Brito, Taboza, Silveira, Teixeira, & Rego, 2022).

Our research group has several ongoing and planned projects relying on registry data (looking e.g. into associations between periodontitis and systemic conditions), in which periodontal data are usually limited to PD. It is therefore of particular interest to assess the diagnostic accuracy of PD as the sole indicator of periodontitis.

Aim and Methods

The aim of the proposed study is to evaluate the diagnostic accuracy of periodontal pocketing (PD \geq 6 mm) in the detection of periodontitis. We also aim to assess the prognostic value of PD in terms of disease progression.

The specific aims will be to assess a) the diagnostic accuracy of periodontal pocketing in the detection of periodontitis at tooth- and patient-level, b) whether repeated measures of periodontal pocketing improve the diagnostic accuracy, and c) the prognostic value of periodontal pocketing in terms of progression of periodontitis at tooth- and patient-level.

A total of 1,200 adult individuals will be randomly selected from a patient population (stratified by age, see below) who attended dental examinations both in 2017/2018 and 2021/2022 within Swedish public dental care (Folk tandvården Västra Götaland, Sweden). To address a potential effect of age on diagnostic accuracy (Baelum, Manji, Wanzala, & Fejerskov, 1995), we will include 200 individuals from each of the following age categories: 20-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years and 70-80 years.

For the 1,200 individuals, periodontal charts and bitewing radiographs will be obtained for the time period 2017-2022 from digital patient records. Those individuals with clinical and radiographic documentation from both 2017/2018 and 2021/2022 will be included in the study. Data analysis should ideally be based on at least 100 subjects in each age category. The measures and outcomes will focus on the premolar-molar region, which is routinely captured on radiographs obtained at regular dental examinations.

The condition to be detected, periodontitis, will be defined as follows:

- At tooth level: radiographic signs of marginal bone loss (distance from CEJ to marginal bone level \geq 3 mm).
- At patient level: \geq 2 non-neighbouring approximal sites in the premolar-molar region with radiographic signs of marginal bone loss.

In a first step, we will cross-sectionally evaluate the diagnostic accuracy of periodontal pocketing (timepoint: 2021/2022) to detect radiographically confirmed periodontitis (timepoint: 2021/2022) through sensitivity, specificity, predictive values, and area under the receiver operating characteristic (ROC) curves. At patient level, we will compare different thresholds of minimum number of teeth presenting with PPD ≥ 6 mm.

Second, we will explore whether the addition of information from previous examinations, i.e. repeated recordings of periodontal pocketing over the time period 2017-2020, improves the diagnostic accuracy (target: radiographically confirmed periodontitis, timepoint: 2021/2022).

Third, we will longitudinally evaluate the prognostic value of periodontal pocketing (timepoint: 2017/2018) to predict progressive marginal bone loss (time period: 2017-2022). Different cut-offs will be compared for periodontal pocketing at patient level.

Ethical considerations

The proposed study entails a certain risk for violation of integrity for the included individuals, mainly during sample selection and data extraction, which will be handled by employees of Folk tandvården Västra Götaland and the University of Gothenburg. All data have been previously collected, and we will not seek specific informed consent from included subjects. Once data extraction has been completed, the dataset will be coded. Results will be presented at group level only, and the possibility of identifying any individual from the collected data will be virtually nil.

The coded dataset will be stored on a protected server at the facilities of the University of Gothenburg. Only authorized personnel responsible for the study will have access to the server. The code key will be stored digitally on a protected server located at the Department of Periodontology.

The knowledge gained from the proposed study will guide the design and interpretation of future research. For instance, a better understanding of the validity of probing depth recordings will be applied in registry-based research on associations between periodontitis and systemic conditions. The potential benefit is therefore considered to outweigh the relatively small risks.

Practical considerations

The list of 1,2000 randomly selected patients in 6 age categories will be provided by Folk tandvården Västra Götaland, identifying the individuals only by a "PMID" code (internal

reference number not including personal ID number nor date of birth). A member of the research team will then access the dental records, from which periodontal charts (2017-2021) and bitewing radiographs (2017/2018 and 2021/2022) will be retrieved. Information regarding age, gender and smoking status will also be obtained from the journal.

The aforementioned radiographs will be saved as a jpeg image file, identified only through the PMID code and date of exposure. Marginal bone loss will be assessed relative to the cemento-enamel junction using a specific imaging software (ImageJ 2.0.0-rc-69/1.52n; National Institutes of Health, Bethesda, MD, USA). Once data extraction has been completed, the PMID code will be substituted by a unique study-specific ID number.

References

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