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ORIGINAL ARTICLE

Different treatment strategies are applied to patients with the same periodontal status in general dentistry

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Abstract

Objective. To analyse how general dental practitioners (GDPs) and dental hygienists judge and plan to treat patients with different periodontal conditions. ***Materials and methods.*** Seventy-seven GDPs and 50 dental hygienists in a Swedish county, Halland, participated in a questionnaire study. The response rate was 94%. The questionnaire consisted of four simulated patient cases and an attached answer sheet. The patient cases had different periodontal status, ranging from healthy to moderate bone loss with general inflammation. The clinicians judged the periodontal status as healthy or diseased. If judged as diseased the clinicians suggested a diagnosis, selected treatment options and estimated the number of treatment sessions for each patient case. The clinicians were compared to each other regarding their judgement, as healthy or diseased, diagnostics and treatment. ***Results.*** Three out of four patients were judged both as healthy and diseased by different clinicians. If judged as diseased the patients were diagnosed as having gingivitis or periodontitis. Regardless of the clinicians' former judgement and diagnostics there were no differences ($p > 0.05$) in the selected treatment options but there was a difference ($p < 0.05$) in the suggested number of treatment sessions. ***Conclusions.*** Clinicians' judgement of the same periodontal condition, as healthy or diseased, varies, which partly results in different treatment decisions considering the number of treatment sessions. The suggested number of treatment sessions varied also between clinicians even if they judged and diagnosed the condition likewise. The willingness to treat and suggested treatment options were not influenced by the variation in judgement and diagnostics.

Key Words: *clinical decision-making, gingivitis, periodontal diseases, periodontitis*

Introduction

Several studies have shown that clinicians judge, diagnose and treat the same state of disease differently [1–4]. The variations in judgement and decision are seen in different areas such as cariology where research has shown that large variations occur between dentists in their diagnoses and restorative treatment decisions [5–7]. On the other hand, the cut-off between health and disease in general is seldom clear-cut and the grey zone between health and disease is wide. The terms healthy or normal are not easy to define as there are different definitions when a condition is considered as normal as opposed to when it is considered as diseased [8].

Gingivitis is defined as the presence of gingival inflammation without loss of connective tissue attachment [9]. Gingivitis is a precursor of periodontitis, but not all gingivitis lesions progress to periodontitis [10]. Chronic periodontitis is defined as an infectious disease resulting in inflammation within the supporting tissues of the teeth, progressive attachment loss and bone loss [11]. Chronic periodontitis affects ~30–70% of the adult population, the wide range depending on how periodontitis has been defined and which population have been studied [12,13]. Since chronic periodontitis is a common disease diagnostics and treatment of periodontal disease is a regular task for general dental practitioners (GDPs) and dental hygienists.

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Table I. The periodontal status of the four patient cases included in the questionnaire.

Patient case	No. of teeth	PLI (%)	BOP (%)	PPD* = 4 mm	PPD* = 5 mm	Marginal bone loss
1	29	7	4	5	0	1/3 of root length
2	26	37	37	24	11	1/3 of root length
3	31	5	5	5	0	Slight bone loss
4	31	30	38	44	0	Slight bone loss

PLI: Plaque index; BOP: Bleeding on probing; PPD: Pocket probing depth.
* Number of sites.

Few studies have focussed on judgement and treatment decisions within periodontology. One study has shown that different categories of clinicians in a faculty setting tend to give more weight, in some instances, to irrelevant findings (plaque, calculus), i.e. findings not supported by the existing evidence when diagnosing chronic periodontitis [14]. Dental hygienist students used significantly more irrelevant findings in comparison to other categories of clinicians. Also, clinical instructors in periodontology vary in their interpretations of clinical findings, in their periodontal diagnostics and in their treatment planning [15]. Furthermore, Persson et al. [16] have shown that periodontists trained at different centres judge the risk of disease progression differently.

These studies were performed in a faculty or specialist environment and we have not been able to find any studies that describe GDPs' and dental hygienists' judgement and treatment decisions considering periodontal diseases in general dentistry. It is important to study this group of clinicians since the majority of patients with different periodontal conditions primarily consult general dentistry. Most of these patients receive their treatment and regular follow-up in this setting.

The general aim was to study GDPs' and dental hygienists' treatment strategies in patients with varying periodontal conditions. The hypotheses that guided this study were:

- The same periodontal condition is judged and diagnosed differently.
- The treatment decisions for patients with the same periodontal condition vary between clinicians.

Materials and methods

Clinicians

All GDPs (77) and dental hygienists (50) from Halland, a county in Sweden, employed by the public dental service, were invited to participate in the study. The study was based on a questionnaire that included four patient cases. Seven clinicians did not return the questionnaire for various reasons, e.g. heavy workload and lack of time to complete the questionnaire. The remaining 74 GDPs and 46 dental hygienists responded, which gave a total response rate of 94%.

The mean age was 45 years for GDPs and 48 years for dental hygienists, with a range of 24–70 years. The mean professional experience was 17 years for GDPs and 15 years for dental hygienists, with a range of 0–41 years. Of the GDPs 62% were women. All dental hygienists were women.

Framework

Based on patient cases, which were presented together with clinical and radiographical findings, we studied how GDPs and dental hygienists judged periodontal conditions, as healthy or diseased. Furthermore, if judged as diseased, how they diagnosed the periodontal conditions (gingivitis/periodontitis). We also studied if a prophylactic treatment or a treatment, *per se*, was proposed. Variation in treatment decisions between clinicians was studied from two perspectives. One perspective was that they interpret the same conditions differently. As a result the treatment decision will vary because they think they see different levels of disease. The other perspective was that they agree about what they see and how it is judged but disagree about how the condition should be treated [17]. This could be due to other factors that influence the treatment decision such as deviant risk assessment, prognostic assessment and treatment goals.

Questionnaire

The questionnaire consisted of four simulated patient cases with different periodontal status (Table I). The anamnesis was identical for the four patient cases and they were all presented with clinical and radiographical findings. The patient cases had bone loss not exceeding 1/3 of the root length, pocket probing depth (PPD) $\leq$ 5 mm or BOP $<$ 40%. All patient cases had the same minor amount of calculus. Radiographs were an aid for the clinicians to detect possible bone pockets and furcation involvements (Figure 1).

Each patient case had an identical answer sheet that consisted of 11 questions. Generally, the questions were of multiple-choice character where clinicians

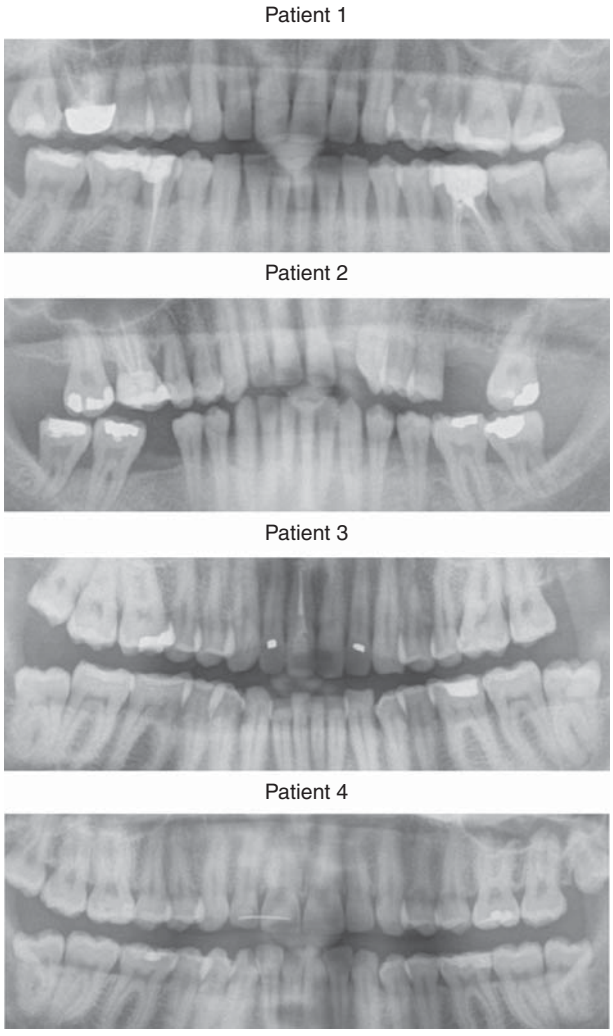

Figure 1. Cropped panoramic images of each patient included in the questionnaire.

could, to begin with, judge if the patient case was periodontally healthy or diseased. If judged as diseased the clinicians were asked to propose a diagnosis. All clinicians were asked to choose treatment options and number of estimated treatment sessions, which could range from none to more than four visits.

Logistics

Following a brief presentation, during a meeting with the clinical supervisors, the questionnaires were distributed together with pre-paid envelopes. On a later occasion the clinical supervisors gathered the employees during a half an hour meeting to complete the questionnaire anonymously. Every questionnaire was coded in order to keep track of the logistics but also to find non-respondents. After 2 weeks a reminder was sent by e-mail to the clinical supervisors whose clinicians had not returned the questionnaires. The study was approved by the Ethics Committee at Lund University, Lund, Sweden.

Analysis

The clinicians were divided into two groups depending on their judgement of the patients as healthy or diseased. The clinicians that judged the patients as diseased were further divided into two groups depending on how they diagnosed the patients. One group consisted of clinicians that diagnosed the patients as having gingivitis and the other group consisted of clinicians that diagnosed the patients as having periodontitis. This division was done in order to study if differences in judgement and diagnostics influenced clinicians' treatment decisions.

Statistics

The Statistical Package for the Social Sciences, version 20 was used for all calculations. Means and 95% CI were calculated for treatment session; > 4 treatment sessions were converted to 5 treatment sessions. *T*-test, one-way analysis of variance (ANOVA) and Tukey's test compared differences. The level of significance was set at $p \leq 0.05$ in all tests.

Results

In the initial analysis of the results GDPs and dental hygienists were compared to each other as groups, but the results showed that there were no significant differences between GDPs and dental hygienists in any parts of the results. Hence, GDPs and dental hygienists are presented together as clinicians.

Judgement

The clinicians' judgement of patients' periodontal condition as healthy or diseased varied in three out of the four patients (Figure 2). The widest variation was found in patient 3, who had the healthiest periodontal condition, in contrast to patient 2, who had the most severe periodontitis. There was also a variation in the given diagnoses (gingivitis/periodontitis) in all patients, except for patient 2 where all clinicians diagnosed the patient as having periodontitis (Figure 3).

Treatment

Some kind of treatment, either as prophylaxis or as treatment, *per se*, was proposed by all clinicians for patients 1, 2 and 4 and by 93% of the clinicians for patient 3.

Suggested treatment options were categorized into three categories: instruction only, instruction together with polishing and debridement often combined with instruction. This categorization was formed from the most frequently occurring answers and combination of answers given by the clinicians.

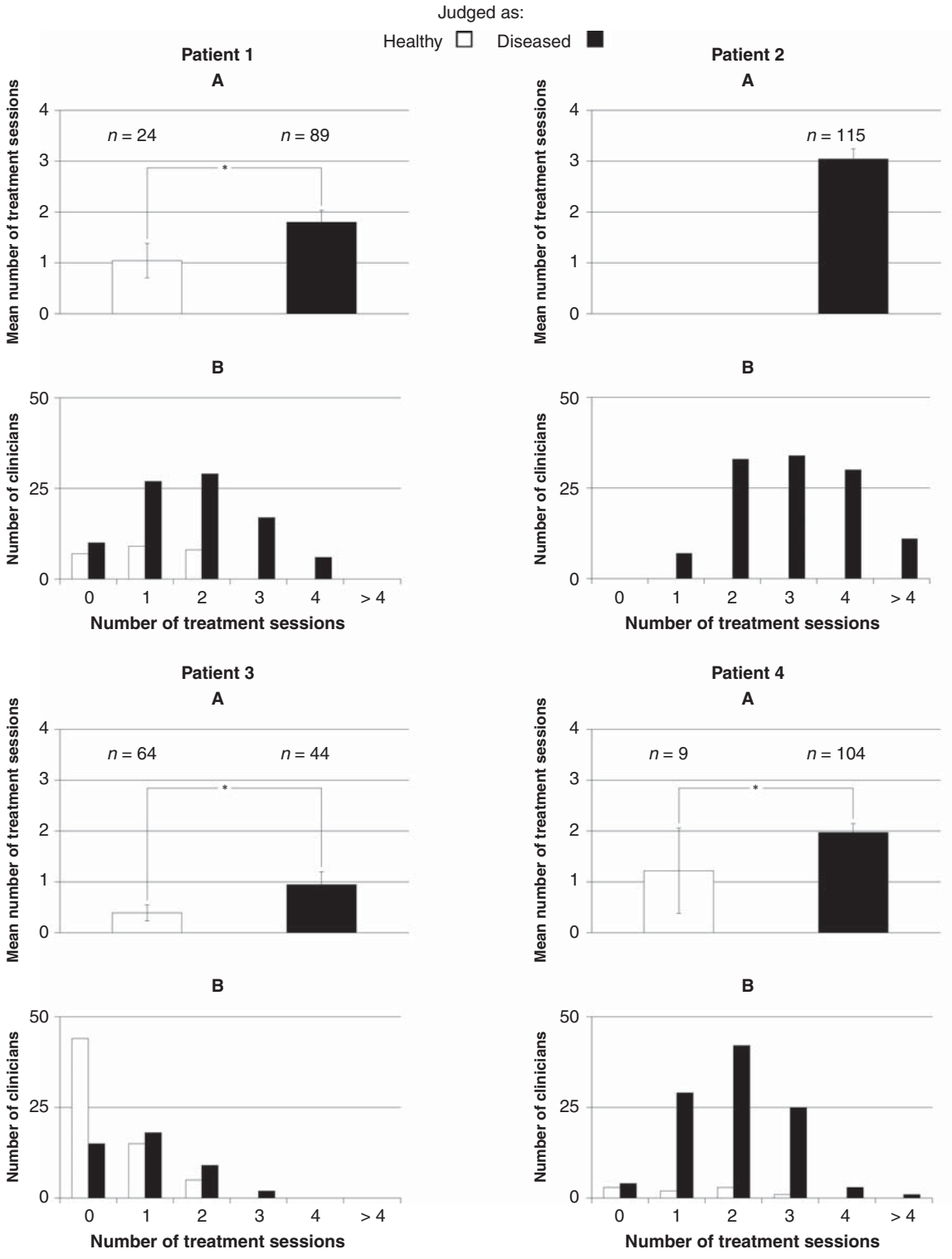

Figure 2. (A) Number of treatment sessions for patients (n = number of clinicians). *$p < 0.05$. Mean and 95% CI. (B) Clinicians' estimation of numbers of treatment sessions for patients.

Whether or not the patients were judged as healthy or as diseased it did not influence the suggested treatment options; neither did the differences in diagnostics (gingivitis/periodontitis). The majority of clinicians proposed debridement (92.7%) often combined with instruction (30.8%).

In general the clinicians estimated a higher number of treatment sessions if they judged the patients as diseased in comparison to the clinicians that judged the patients as healthy (Figure 2A). The variation in number of treatment sessions within the groups of clinicians that judged the patients as

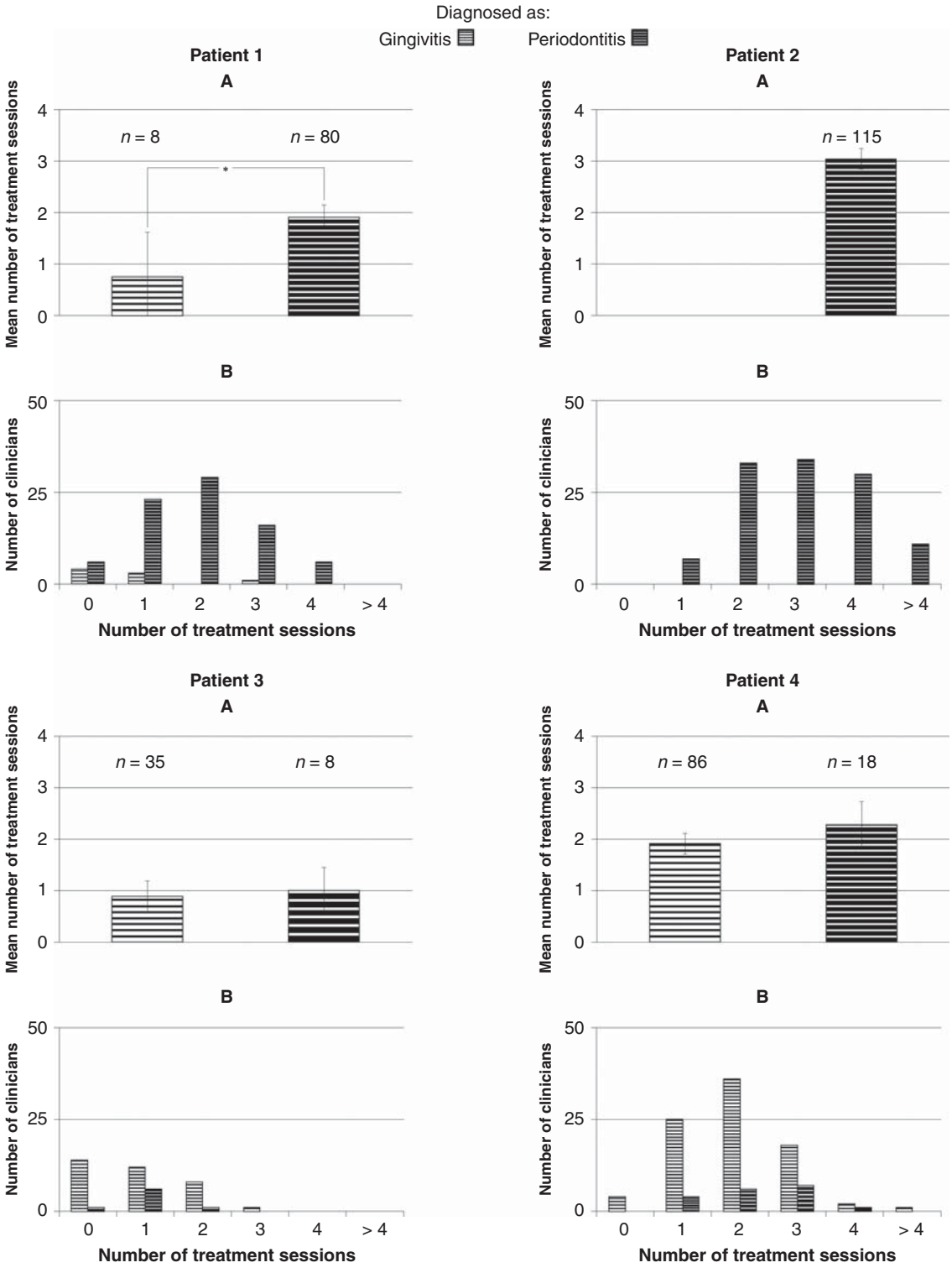

Figure 3. (A) Number of treatment sessions for patients (n = number of clinicians). *$p < 0.05$. Mean and 95% CI. (B) Clinicians' estimation of numbers of treatment sessions for patients.

healthy or diseased is presented in Figure 2B. In patient 1 the number of estimated treatment sessions was also higher if the given diagnosis was periodontitis instead of gingivitis (Figure 3A). The variation in number of treatment sessions within the groups of clinicians that diagnosed the patients as having gingivitis or periodontitis is presented in Figure 3B. Patients 3 and 4 were proposed the same number of treatment sessions, although they were diagnosed differently.

Discussion

Methodological consideration

Halland County was chosen in this study because the population of clinicians corresponds to the general population of clinicians in Swedish general dentistry, when accounting for variables such as number of clinicians per inhabitants, gender distribution and ratio between number of general dental practitioners (GDPs) and dental hygienists [18]. The patient cases in the questionnaire sought to resemble, as far as possible, a real clinical situation where patients are examined and proposed a treatment plan. This was made possible because the questionnaire comprised the information a clinician usually retrieves during a clinical examination, e.g. anamnesis, clinical and radiographical findings.

The questions that were presented to clinicians were mostly close-ended; this means that the clinicians were limited when answering which could influence the results. Therefore, it was of high importance to create several answer options to reduce the omission of data.

One limitation of questionnaire studies is the response rate. While it is naive to expect a response rate of 100%, the rate should fall in proximity of 60% in order to have dependable results [19]. In this study the response rate was 94%, which indicates strong dependable results and no need for a failure analysis was found. The main explanation for the high response rate was the contact that was established with the chief supervisor of the public dental service in Halland County prior to performing the study; the chief supervisor also had an interest in the realization of the study and, thus, accepted its implementation. This could be interpreted as the clinicians being under pressure to complete the questionnaire, which could have influenced the content of their answers, but since the questionnaire was anonymous and participation was optional this probability was considered as low.

Diagnostic criteria

As stated in an earlier publication [11], chronic periodontitis is 'an infectious disease resulting in inflammation within the supporting tissues of the teeth, progressive attachment, and bone loss' (p. 38). Inflammation of the periodontal tissue is best examined by bleeding on probing (BOP) [9,20]. BOP is a widely used clinical parameter to determine inflammation of the gingiva [21], since the method has high sensitivity (91%) and fair specificity (77%) [22].

Clinicians measure supportive tissue loss mostly by determining PPD and bone level on radiographic images in contrast to clinical attachment level that is mostly used in research environments. Measuring pocket probing depth (PPD) is not a reliable method to determine attachment loss [23,24]. The method has some limitations since it tends to over-estimate the depth of a periodontal pocket in diseased sites while it under-estimates the depth in healthy sites. Diseased sites could also show swelling of the gingiva and, hence, present higher PPD not necessarily indicating occurrence of attachment loss and healthy sites could show normal PPD values (< 4 mm), although an attachment loss has occurred [25].

Radiographic examination, often by bitewings, is regularly used by clinicians to evaluate supportive tissue loss (STL), even though periapical radiographs are considered more valid [26,27]. It is possible to measure the progression of bone loss through radiographic examination, but it requires two observations spaced in time in order to see if progression has occurred [28,29]. The average annual rate of bone loss ranges from 0.07–0.16 mm according to longitudinal studies (a 10-year period), which included a randomized population [30,31]. It is not possible to see this subtle change in bone height annually as there are measurement errors with the methods used. In order to see, with certainty, 1 mm loss in crest height it would take 13–19 years if an annual loss of 0.1 mm occurred [32]. In addition to this there is also an inter-observer variation for determining bone height, with the range of ±1–2 mm, which could further influence the detection of subtle changes in bone height [27]. This means that, if no clinical parameter indicates a more excessive bone loss, there is no need for annual radiographic examinations. Furthermore, if progression of bone loss is seen between two radiographic examinations it does not necessarily mean that it is actively occurring [25], since there are not any known reliable and clinically feasible methods at present that could measure this parameter.

For the patient cases in this study there were only radiographic images from one occasion. This implies that progression of bone loss could not have been evaluated. This shortcoming might have caused uncertainty in interpretation of findings and could have influenced the judgement and the succeeding diagnostics. On the other hand new patients often lack previous radiographic images and clinical data. Additionally no explicit defining criteria for periodontitis have yet been established, which could have also contributed to clinicians' uncertainty [28].

Treatment

In a clinician's decision process the step succeeding the diagnosis of a periodontal condition is to decide what kind of treatment the patient needs and determine the purpose of it, as prophylaxis or treatment, *per se*. In this study almost all clinicians intended to treat all patient cases, nearly all suggesting the same treatment option which was debridement often combined

with instruction. This could indicate that a patients' periodontal condition was not of importance when clinicians decided if treatment was needed and if so which treatment option should be used.

Furthermore, clinicians suggested a different number of treatment sessions for the same patient. The difference was partly due to a variation in their judgement of the patients' periodontal conditions as healthy or diseased. Variation also existed between clinicians who made the same judgement of the patient's periodontal condition, as healthy or diseased. This indicates that there was also a variation in the decision of how a certain condition should be treated. Differences in treatment sessions stemmed from both possible sources of variation [17]. This last variation existed in both groups that judged the patients as healthy or diseased and further in groups that diagnosed the patients as having gingivitis or periodontitis after they had been judged as diseased. Another reason for variation in treatment sessions could be that clinicians have deviant treatment goals concerning periodontal treatment [33,34] or that that they are divergent in their prognostic judgement.

This shows that if the clinicians are to be more coordinated in their periodontal treatment they have to be more coherent in their view of when a patient is periodontally healthy or diseased. Additionally other factors influencing treatment decisions have to be further examined in order to see what influences the clinicians to make different treatment decisions, although their judgement of a periodontal condition is coherent.

Limitations of the study

In a clinician's decision process the characteristics of the patient and risk factors, such as the patient's general health, medication and disease history, influence the treatment choice [35]. We have chosen to eliminate these factors since we are only interested in clinicians' treatment decisions when they analyse findings related to the judgement of the periodontal condition and not accounting for patients' characteristics. Further the clinicians were not aware of the patients' own preferences about the treatment, which is an important factor in treatment planning [36].

Concluding remarks

This study has shown that clinicians' judgement of the same periodontal conditions, as healthy or diseased, varies, which means that there was no consensus regarding diagnostic criteria for periodontal diseases. As a result of this the treatment decisions concerning the number of treatment sessions varies because clinicians perceive periodontal conditions differently. However, at the same time there were clinicians that agreed on what they had seen but still disagreed about how a certain periodontal condition should be treated. On the other hand, the clinicians' judgement and diagnostics did not influence the willingness to treat and treatment decisions regarding treatment options, which means that patients' periodontal conditions were not of importance when clinicians decided if any treatment was needed and if so which treatment options should be used.

This could indicate that patients with periodontal diseases are receiving treatment unsuitable to their periodontal conditions, i.e. they could be under- or over-treated in relation to their treatment need. Furthermore, the periodontal care will differ if the patient were to visit different clinicians.

This might imply that the resources in general dentistry are ineffectively used due to the lack of conformity in clinicians' judgement and treatment decisions. Therefore, there is a need to further investigate factors influencing clinicians' judgements and decisions in periodontal care, e.g. their established treatment goals and capability to predict disease progression. There is also a need to improve the diagnostic method for periodontal diseases in order to enhance the agreement between clinicians in their judgement of patients with periodontal diseases.

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References

[1] Wigton RS. Applications of judgement and analysis and cognitive feedback to medicine. In Brehmer B, Joyce CRB, editors. Human judgement: The SJT view. Amsterdam: Elsevier Sciences Publishers BV; 1988. p. 227–45.

[2] Knutsson K, Ohlsson B, Troein M. Clinicians' management strategies for patients with dyspepsia: a qualitative approach. BMC Gastroenterol 2005;5:15.

[3] Knutsson K, Lysell L, Rohlin M. Dentists' decisions on prophylactic removal of mandibular third molars: a 10-year follow-up study. Community Dent Oral Epidemiol 2001;29: 308–14.

[4] Rawski AA, Brehmer B, Knutsson K, Petersson K, Reit C, Rohlin M. The major factors that influence endodontic retreatment decisions. Swed Dent J 2003;27:23–9.

[5] Noar SJ, Smith BG. Diagnosis of caries and treatment decisions in approximal surfaces of posterior teeth *in vitro*. J Oral Rehabil 1990;17:209–18.

[6] Kay EJ, Locker D. Variations in restorative treatment decisions: an International comparison. Community Dent Oral Epidemiol 1996;24:376–9.

[7] Baraba A, Domejean-Orliaguet S, Espelid I, Tveit AB, Miletic I. Survey of Croatian dentists' restorative treatment decisions on approximal caries lesions. Croat Med J 2010;51:509–14.
[8] Levi R. Not sick, not healthy. Med Sci Pract 1995;2:8.
[9] Armitage GC. Clinical evaluation of periodontal diseases. Periodontol 2000 1995;7:39–53.
[10] Lang NP, Schätzle MA, Löe H. Gingivitis as a risk factor in periodontal disease. J Clin Periodontol 2009;36:3–8.
[11] Lindhe J, Ranney R, Lamster I, Charles A, Chung C-P, Flemmig T, et al. Consensus report: chronic periodontitis. Ann Periodontol 1999;4:38.
[12] Armitage GC. Development of a classification system for periodontal diseases and conditions. Ann Periodontol 1999;4:1–6.
[13] Hugoson A, Sjodin B, Norderyd O. Trends over 30 years, 1973–2003, in the prevalence and severity of periodontal disease. J Clin Periodontol 2008;35:405–14.
[14] Leisnert L, Hallström H, Knutsson K. What findings do clinicians use to diagnose chronic periodontitis? Swed Dent J 2008;32:115–23.
[15] Lanning SK, Pelok SD, Williams BC, Richards PS, Sarment DP, Oh TJ, et al. Variation in periodontal diagnosis and treatment planning among clinical instructors. J Dent Educ 2005;69:325–37.
[16] Persson GR, Attström R, Lang NP, Page RC. Perceived risk of deteriorating periodontal conditions. J Clin Periodontol 2003;30:982–9.
[17] Kay E, Nuttall N. Clinical decision making: an art or a science?. London: BDJ Books; 1997.
[18] Prognos över sysselsatta inom hälso- och sjukvården samt tandvården – Åren 2009–2025. (This is a Swedish report). Stockholm, Sweden: The National Swedish Board of Health and Wellfare; 2011. Available online at http://www.socialstyrelsen.se/publikationer2011/. accessed 16 January 2011.
[19] Baruch Y. Response rate in academic studies-A comparative analysis. Hum Relat 1999;52:421–38.
[20] Greenstein G. The role of bleeding upon probing in the diagnosis of periodontal disease. A literature review. J Periodontal 1984;55:684–8.
[21] Mühlemann HR, Son S. Gingival sulcus bleeding – a leading symptom in initial gingivitis. Helv Odontol Acta 1971;15:107–13.
[22] De Souza PH, de Toledo BE, Rapp GE, Zuza EP, Neto CB, Mendes AJ. Reliability of bleeding and non-bleeding on probing to histological features. J Int Acad Periodontol 2003;5:71–6.
[23] Biddle AJ, Palmer RM, Wilson RF, Watts TL. Comparison of the validity of periodontal probing measurements in smokers and non-smokers. J Clin Periodontol 2001;28:806–12.
[24] Fowler C, Garrett S, Crigger M, Egelberg J. Histologic probe position in treated and untreated human periodontal tissues. J Clin Periodontol 1982;9:373–85.
[25] Wolf DL, Lamster IB. Contemporary concepts in the diagnosis of periodontal disease. Dent Clin North Am 2011;55:47–61.
[26] Douglass CW, Valachovic RW, Wijesinha A, Chauncey HH, Kapur KK, McNeil BJ. Clinical efficacy of dental radiography in the detection of dental caries and periodontal diseases. Oral Surg Oral Med Oral Pathol 1986;62:330–9.
[27] Åkesson L, Håkansson J, Rohlin M. Comparison of panoramic and intraoral radiography and pocket probing for the measurement of the marginal bone level. J Clin Periodontol 1992;19:326–32.
[28] Baelum V, Lopez R. Defining and classifying periodontitis: need for a paradigm shift? Eur J Oral Sci 2003;111:2–6.
[29] Jeffcoat MK, Roddy MS. Advances in measurements of periodontal bone and attachment loss. Monogr Oral Sci 2000;17:56–72.
[30] Papapanou PN, Wennström JL, Gröndahl K. A 10-year retrospective study of periodontal disease progression. J Clin Periodontol 1989;16:403–11.
[31] Lavstedt S, Bolin A, Henrikson CO. Proximal alveolar bone loss in a longitudinal radiographic investigation. II. A 10-year follow-up study of an epidemiologic material. Acta Odontol Scand 1986;44:199–205.
[32] Benn DK. A review of the reliability of radiographic measurements in estimating alveolar bone changes. J Clin Periodontol 1990;17:14–21.
[33] Wennström JL, Papapanou PN, Gröndahl K. A model for decision making regarding periodontal treatment needs. J Clin Periodontol 1990;17:217–22.
[34] Sheiham A, Netuveli GS. Periodontal diseases in Europe. Periodontol 2000 2002;29:104–21.
[35] Page RC, Beck JD. Risk assessment for periodontal diseases. Int Dent J 1997;47:61–87.
[36] Liedholm R, Knutsson K, Lysell L, Rohlin M, Brickley M, Shepherd JP. Outcomes of mandibular third molar removal and non-removal: a study of patients' preferences using a multi-attribute method. Acta Odontol Scand 2000;58:293–8.