Factors affecting decision making at reassessment of periodontitis. Part 2: interpretation of clinical findings – systemic factors

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Key points

- The impact of systemic factors on periodontal disease are outlined.
- Suggests systemic factors need to be assessed and corrected to stabilise periodontal disease.
- Points out that the association of periodontitis with systemic diseases should be relayed to the patient.

Abstract

This paper is the second in a four-part series outlining treatment planning at periodontal reassessment. The first article focussed on the information that should be gathered at the reassessment appointment. Treatment can involve a range of non-surgical and surgical approaches. A variety of general, practical and local site factors can affect the choice of one option over another in choosing the most predictable treatment option. Residual periodontal probing depths can be associated with both systemic and local factors. This article (part 2) outlines systemic factors that need to be assessed when faced with residual periodontal probing depths.

Interpretation of clinical findings

The information collected as outlined in part one of this series should be analysed. If no residual pockets are present, then the patient should enter a maintenance programme of supportive periodontal therapy (SPT) to maintain their periodontal health. SPT involves ongoing regular periodontal assessment, oral hygiene re-enforcement and full mouth debridement.[1] Controlled oral hygiene and SPT has been well established as being associated with lower caries and periodontal disease levels over 30 years.[1,2,3,4]

If residual pockets in excess of 4 mm are present, the clinician must elucidate their cause and whether further treatment is warranted. The presence of periodontal probing depths of 5 mm or more has been shown to act as a risk factor for tooth loss over a period of up to 27 years in 172 patients who had undergone active and supportive periodontal therapy.[5] This has been supported by a study assessing patients in supportive periodontal therapy.[6] In view of this, for the purposes of this series, residual pockets are defined as those of 5 mm or more following a course of initial periodontal therapy. The potential systemic causes for these are outlined below and the recent World Workshop on Periodontal and Peri-implant Diseases and Conditions highlights the importance of these factors.[7] The consensus outlined a new classification of systemic diseases associated with periodontitis, the broad categories of which are systemic disorders that have a major impact on the loss of periodontal tissue by influencing periodontal inflammation, other systemic disorders that influence the pathogenesis of periodontal diseases and systemic disorders that can result in loss of periodontal tissue independent of periodontitis.[8] The aim of the present paper (Part 2 in the series) is to provide an overview to many of the systemic factors that need to be considered when reassessing patients with periodontal disease. Attempts should be made to reduce the impact of these factors at reassessment, if not already corrected.

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Smoking

Strong evidence is available to support smoking as a major risk factor for periodontitis including increased alveolar bone loss, pocket formation and tooth loss; however, the signs and symptoms of inflammation are greatly decreased.[9,10] This masks the severity of the disease to the patient. Smoking increases the risk of severe periodontitis by three times and the effects are cumulative over time.[11,12] Additionally, the magnitude of the effect depends on the dose, type and frequency of smoking.[13] Smoking cessation can reduce the effects on the periodontium, but this can take decades.[14] Smoking will affect healing and the response to treatment with smokers having been shown to hold only 28% of the periodontal healing capacity of non-smokers.[15] Non-surgical therapy in smokers results in less clinical attachment gain and pocket depth reduction, especially for sites showing attachment loss over 4 mm.[16] Smokers will show improvement with non-surgical therapy, but not as much as their non-smoking counterparts.

The use of antimicrobials, whether systemic or topical, have been shown to improve

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Box 1 Causes of immunosuppression

- Mucous membrane barrier defects
- Mucositis induced by irradiation and chemotherapy
- Quantitative and qualitative neutrophil defects
- Acute leukaemia
- Chronic lymphocytic leukaemia
- Aplastic anaemia
- Hodgkin's disease
- Multiple myeloma
- Childhood immunodeficiency
- HIV disease
- Ageing
- Bone marrow transplant recipients
- Abnormal cell-mediated immunity
- Abnormal humoral immunity
- Combined immunodeficiency
- Chemotherapy for malignancies
- Corticosteroid administration
- Immunomodulating medications.

The original information listed in this box can be found in reference.[38]

outcomes in non-surgical therapy when their use is indicated; however, the authors avoid their use in smokers in order to minimise the risk of antimicrobial resistance where quitting smoking is likely to have the biggest impact on the periodontal condition.

Smokers show less improvements in probing depths and clinical attachment levels following surgery.[17] Smokers exhibit approximately 2 mm less bony infill in guided tissue regeneration compared with non-smokers.[18] If a patient is continuing to smoke, smoking cessation advice should be undertaken at the outset in order to optimise the outcome of any treatment. Patients who do quit smoking should be warned of increased gingival bleeding due to the loss of smoking's masking effect on signs of periodontal disease.

The prevalence of smoking has declined with time; however, the use of e-cigarettes (vaping) has increased up until the early part of this decade, since when vaping use has slowed in England.[19,20] These devices use an electrical heating element to aerosolise a liquid containing propylene glycol with or without vegetable glycerin, flavourings, and nicotine.[21] Stopping smoking and switching to an e-cigarette results in the same recovery in inflammatory response seen in quitters using other means at 2 weeks, suggesting no effect of the e-cigarette, but further research is required.[22] Current research suggests that vaping is less harmful than smoking.[23] The vapour inhaled varies depending on device type, user experience and behaviour, power, liquid contents, and materials that make up the heating element and device liquid reservoir.[24] E-cigarettes are constantly evolving and the evidence base providing a detailed analysis of their toxicity is rapidly developing. There is emerging evidence showing their benefit in smoking cessation alongside behavioural support, including compared with nicotine replacement therapies.[25,26] Current advice is that vaping is at least 95% safer than tobacco smoking. Smokers should be supported to stop smoking. If smokers are using or are interested in using an e-cigarette it should not be discouraged by the dentist.[11,27]

Diabetes

Diabetes (both type 1 or 2) has been shown to modify patients' periodontal condition, especially if plaque control is poor.[28,29] Evidence is emerging to suggest specific periodontal pathophysiology in diabetic patients.[7] Patients with well controlled diabetes are deemed to be at low risk of periodontitis.[30,31] The increase in risk is likely due to reduced blood flow to the gingival tissues, an impaired cellular response to periodontal bacteria and impaired wound healing. There is evidence showing that systemic inflammation results from oral microbial elements entering the circulation. It has been hypothesised that these elements can impact on diabetic control, beta-cell function, insulin resistance and development of type 2 diabetes.[32] The main pathogenic mechanisms linking diabetes and periodontitis include hyperglycaemia causing irreversible advanced glycation end-product (AGE) formation and the expression of their chief signalling receptor RAGE. This results in immune cell dysfunction, phenotype and periodontal cell function alteration and exacerbates cytokine imbalance resulting in increased generation of pro-inflammatory cytokines. Hyperglycaemia also contributes to increased levels of reactive oxygen species (ROS) and a state of oxidative stress, which also changes cytokine profiles. Hyperglycaemia modulates the RANKL/OPG ratio both directly and via the AGE/RAGE axis, favouring inflammation. Diabetes-associated adiposity and dyslipidaemia results in circulating adipokines, adding to cellular dysfunction and inflammation. Many of these pathways are bidirectional, exacerbating the level of inflammation. The pathogenic mechanisms may be modified by the other systemic factors outlined in this article.[33]

Patients with well controlled diabetes have been shown to have similar responses to non-surgical and surgical treatment compared with their healthy counterparts.[34] If a patient's diabetic control is poor, it will affect the response to initial therapy and liaison with the general medical practitioner should be undertaken to improve diabetic control, before undertaking further treatment, despite evidence suggesting dental professionals to be reluctant in doing so.[35] In addition, evidence is emerging that poor periodontal control may have an impact on glycaemic control, diabetic complications and the development of diabetes.[32,36,37,38] Moderate to severe periodontitis is associated with increased risk for macroalbuminuria, end-stage renal disease, calcification of atherosclerotic plaques, carotid intimamedial thickness and cardio-renal mortality.[32] Patients with severe periodontitis appear to be at higher risk of developing diabetes.[32] Patients' diabetic control can be assessed by liaising with their medical practitioner to establish their glycated haemoglobin levels (HbA1C), these should be 6.5% (48 mmol/mol) or lower.[39] Periodontal treatment has been shown to decrease HbA1C levels by 0.36% at 3 months, which is equivalent to administering a second diabetic medication.[40] Diabetic patients should be informed of the association between diabetes and periodontitis and liaison with the medical practitioner undertaken where it appears diabetic control may be poor.

Pregnancy

Pregnancy is associated with gingival enlargement and formation of pyogenic granulomas (highly vascular overgrowths of tissue, secondary to irritation, trauma or hormones) in the presence of plaque.[41]

Changes and increases in sexual hormones during pregnancy inhibit T-cell activity, reduce chemotaxis and phagocytosis of neutrophils, alter lymphocyte response and decrease antibody production. Chronic maternal stress and nutritional deficit can also have an impact. Gingival capillary permeability and hence an increase in the flow of crevicular fluid can occur. Increased progesterone levels favour the development of Prevotella intermedia.[42]

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The inflammation is likely to resolve after childbirth, given adequate oral hygiene and non-surgical therapy.[41] Non-surgical therapy can be performed at any time during pregnancy; however, it is ideally undertaken early in the second trimester, as the foetus is most sensitive prior to this and later on in pregnancy stresses can induce childbirth. Occasionally, pyogenic granulomas may require surgical removal. Periodontal disease appears to have an impact on adverse pregnancy outcomes; however, the benefit of periodontal therapy for this remains unclear.[43,44,45]

Medications

A number of drugs have been linked with gingival overgrowth, the most common are phenytoin, cyclosporine and the calcium channel blockers. There are few reports of cases associated with other drugs. Estimates of patients suffering this side effect are 50% for phenytoin, 30% for cyclosporine and 10% for the calcium channel blockers.[46] Older patients are more likely to suffer this side effect. There is no evidence to support whether this side effect is dose dependent.[47] When these drugs are taken in combination with each other, or other medications, they may increase the likelihood of gingival overgrowth occurring, but not the severity.[48] Conversely, the concomitant use of azathioprine or prednisolone may decrease the risk of gingival overgrowth.[49] The pre-existing presence of plaque and gingival inflammation also increases the risk of overgrowth and hence residual pockets.[46] If a patient's oral hygiene is good prior to taking these medications, there may be no effect on the gingivae and it is important to explain this to patients to ensure they understand the importance of optimising their plaque control. Periodontal treatment should be aimed at decreasing the bacterial load and liaison with the patient's medical practitioner should be made, to explore whether there are any alternative medications that could be prescribed. If all measures have been exhausted then gingivectomy may be indicated; however a risk of recurrence remains.

It was previously thought that the oral contraceptive pill may have an impact on periodontitis. Historically, this was supported by a number of poorly conducted studies at a high risk of bias, at a time when the contraceptive pill contained far higher doses of oestrogen and progestin compared to those most commonly prescribed currently. More recent studies do not support a role for the pill in exacerbating periodontitis and hence it is no longer perceived as a modifying factor in periodontitis.[50]

Immunosuppression

Common causes of immunosuppression are listed in Box 1. Patients on immunosuppressive drugs for organ transplants have shown little difference to their healthy counterparts in terms of periodontitis.[51,52,53,54] This may be because these patients receive extensive antimicrobial therapy.[55] There remains no consensus as to the need for antimicrobials in the provision of non-surgical periodontal treatment for organ transplant patients; the decision should be made based on the patient's clinical needs, level of immunosuppression and graft stability.[53,56]

Leukaemias are another cause of immunosuppression and enhanced periodontal bone loss and plaque accumulation has been shown in this subset of patients.[57] Plaque control and non-surgical therapy are of paramount importance in these patients.

Neutrophils are the first line of defence against bacteria in the periodontium. Defects in neutrophil number or function result in early and rapid periodontal destruction.[56] Defects in function can affect phagocytosis, oxidative pathway killing and polymorphonuclear leukocyte chemotaxis. Defects in number are termed as neutropenia. Several types of neutropenias are associated with periodontitis including agranulocytosis, cyclic neutropenia, chronic benign neutropenia, chronic idiopathic neutropenia and familial benign neutropenia. Chemotherapy is the most common cause for neutropenia in periodontitis patients. Monthly professional plaque and calculus removal and rinsing with 0.2% chlorhexidine during neutropenia can help to prevent clinical attachment loss.[56]

Human immunodeficiency virus (HIV) and the resulting acquired immune deficiency syndrome (AIDS) are often associated with necrotising ulcerative stomatitis, necrotising ulcerative periodontitis, linear gingival erythema and periodontitis. Most research available suggests an association with gingival recession and loss of clinical attachment; however, the extent and mechanisms to which this occurs are poorly understood.[34] Non-surgical therapy can be provided, and even surgical therapy if the immune system is competent.[58] Further research is required to evaluate treatment response in these patients but it is still possible to achieve long-term periodontal stability in this group.[59]

Stress

Chronic stress can have a negative effect on the immune response. Stress may also be associated with anxiety and depression and how an individual perceives or reacts to difficulties will affect their physiological response. A number of studies have investigated stress as a risk factor for periodontitis with the majority of them showing a positive relationship.[60] Physiological changes have been implicated in this effect, in addition to stress-related behaviour changes including poor oral hygiene, a change to dietary intake, increased smoking and alcohol intake and decreased dental attendance.[34] Increased stress and certain personality types have shown a decreased response to non-surgical therapy.[36,61] If a patient reports high stress levels it may be worth suggesting liaison with their general medical practitioner to provide support for their wellbeing.

Diet

Diet has been shown to have an impact on inflammation and a number of systemic diseases. It has been investigated as a risk factor for periodontitis and the research thus far is equivocal.[62] It is felt that this may be due to limitations in study design. Evidence is emerging suggesting an association between serum micronutrient levels and periodontitis.[63,64] Putative causes for this may include poor diet, genetic factors and lifestyle factors, including smoking. Frequent sugar intake is associated with increased gingivitis.[65] A diet high in fibre, anti-oxidants and fish oils and low in refined sugar has been shown to significantly decrease gingival bleeding, despite a lack of oral hygiene measures resulting in increased plaque levels and periodontal pathogens.[66]

A recent study has also shown that supplementation with food and vegetable concentrate resulted in increased pocket depth reduction in non-surgical therapy.[67] This study was part of the 2011 European Workshop on Periodontology and suggestions were made to include advice to all patients on increasing intake of fish oils, fibre, fruit and vegetables and to reduce levels of refined sugars. The clinician should advise this for all periodontitis patients.

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Alcohol

Alcohol has a number of effects on health due to its immunosuppressive properties. Limited evidence is available to support its role as a risk factor for periodontitis.[68] If a patient is drinking more alcohol than recommended, it is worth providing alcohol cessation advice.[69] If a patient is alcohol-dependent the usual precautions for dental treatment should be undertaken.

Puberty

Patients undergoing puberty may show an exaggerated periodontal response to plaque. This will usually respond to initial therapy if plaque control is optimised.[41]

Hyperparathyroidism

Hyperparathyroidism due to adenomas (primary hyperparathyroidism) or chronic renal failure (secondary hyperparathyroidism) has been associated with increased bone loss, tooth loss and poor oral hygiene.[70,71] More recent studies have shown decreased cortical bone density, an increased incidence of tori and increased width of periodontal ligament, but with no differences with healthy patients in terms of periodontal disease. Hyperparathyroidism may be a risk factor for periodontitis and its presence should be considered when managing periodontal disease in these patients.[7,72,73] Hyperparathyroidism is one of many potential causes of osteoporosis. Osteoporosis is a disease of decreased bone strength and an associated increased risk of fracture. Most studies investigating a relationship between osteoporosis and periodontal bone loss have shown significance, the largest of which was a cross-sectional observational study of 1,256 post-menopausal women.[74,75] A small increase in loss of attachment is predicted in osteoporosis.[7] Therefore management of the underlying osteoporosis should be stressed.

Cardiovascular disease

Evidence exists to suggest an association between cardiovascular disease and periodontitis with theories put forward suggesting that periodontal bacteria can contribute to atheromas.[38,76,77] A 2013 joint European Federation of Periodontology and American Academy of Periodontology consensus reported strong evidence that periodontitis increases the risk for cardiovascular disease whilst a 2017 Cochrane review reported a lack of evidence to support periodontal treatment in reducing the recurrence of cardiovascular disease in periodontitis patients.[78,79] Patients should be made aware of the association and the fact that the exact relationship between cardiovascular disease and periodontitis has not been established. The discussion should provide the opportunity to emphasise the importance of self-performed plaque control and minimisation of shared risk factors.

Obesity

Obesity and being overweight has also shown a modest association with increased periodontitis rates.[7,80,81,82,83,84,85] The exact mechanism has not been established and common risk factors could well play a part. There is suggestion that these patients respond less favourably to periodontal treatment.[86,87] Obese patients should be made aware of this in an attempt to motivate holistic health behaviour change.

Summary

Where residual probing depths are present, they may be associated with a wide range of systemic and local factors or a combination of both. Systemic factors that require assessment include diabetes, smoking, pregnancy, immunosuppression, medications, stress, diet, alcohol, puberty, hyperparathyroidism, cardiovascular disease and obesity. When the associated factors have been determined, treatment options appraisal can be effectively undertaken followed by further detailed planning and treatment provision.

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