

Factors affecting decision making at reassessment of periodontitis. Part 1: history and examination at reassessment

Amardip S. Kalsi,^{*1} Deborah I. Bomfim² and Zahra Hussain²

Key points

Points out that periodontal reassessment is distinct from initial assessment in that the patient's response to initial therapy will be apparent.

Indicates that a thorough assessment should be taken to aid decision-making.

Outlines the method of history and examination at reassessment.

Abstract

Periodontal therapy aims to arrest the disease while maintaining function and aesthetics. Reassessment allows an opportunity to assess the periodontal status and need for further treatment. This is distinct from initial assessment in that the patient's response to initial therapy will be apparent and many treatment options other than non-surgical therapy require consideration. This series of papers outlines the processes to undergo at periodontal reassessment in order to assess viable treatment options and decide on a plan. This first article focuses on the information that should be gathered at the reassessment appointment in order to allow a full view of a case to aid decision-making. Subsequent papers in this series discuss the systemic and local factors that can account for residual probing depths, assessment of prognosis and treatment planning. Reassessment should be undertaken in a detailed manner to establish the reasons for any residual periodontal probing depths which will lead to the appropriate treatment option.

Introduction

Periodontitis has been defined as an infectious disease causing inflammation within the supporting tissues of the teeth, which results in progressive attachment and bone loss.¹ It results in loss of periodontal ligament, alveolar bone and connective tissue. It is characterised by pocket formation, with or without gingival recession. Periodontal pockets are pathological fissures between a tooth and crevicular epithelium with their apex at the junctional epithelium. They are caused by apical migration of the junctional epithelium along the root as the periodontal ligament is detached.¹

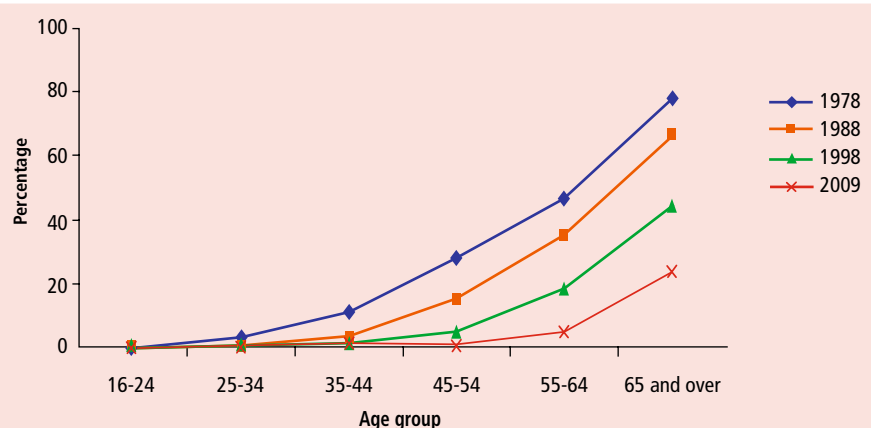
The broad classifications of periodontitis have recently been updated and are

summarised in Box 1.^{2,3,4} Broad classifications of aggressive and chronic periodontitis are no longer used and staging and grading have now been incorporated into periodontal diagnosis. In England, Wales and Northern Ireland, active periodontitis is prevalent in 50% of the population, with prevalence increasing with age with 19% of 16–24-year-olds affected, compared with 76% of those over 85 years

of age. The prevalence of periodontitis has remained steady over the last 20 years.⁵ This may be attributable to more people retaining their teeth for longer (see Fig. 1), as well as general improvements in oral hygiene. Due to this, treatment of periodontitis will be a common occurrence for the foreseeable future.

The aim of periodontal therapy is to arrest and stabilise the disease while maintaining

Fig. 1 Trends in percentage edentate by age; England; 1978-2009. Reproduced from the Adult Dental Health Survey 2009⁵



¹Speciality Trainee Registrar in Restorative Dentistry, Eastman Dental Hospital, 47-49 Huntley Street, London WC1E 6DG; ²Consultant in Restorative Dentistry, Eastman Dental Hospital, 256 Grey's Inn Road, London, WC1X 8LD.
*Correspondence to: Amardip S. Kalsi
Email: amardip.kalsi@nhs.net

Refereed Paper.

Accepted 10 June 2019

<https://doi.org/10.1038/s41415-019-0850-1>

Box 1 Broad classification of periodontitis

- Necrotising periodontitis
- Periodontitis as a direct manifestation of systemic diseases
- Periodontitis.³

function and aesthetics. Goals in line with this include decreasing bacterial deposits and resolving periodontal pocketing, bleeding and mobility. The initial phase of treatment for periodontitis will invariably include oral hygiene instruction (OHI) and associated preventative advice (for example, smoking cessation), an attempt to aid the patient to control any systemic modifiers if appropriate (for example, improved management of diabetes mellitus),

correction of any local plaque retentive factors (for example, overhanging restoration margins) and non-surgical periodontal therapy (NSPT) – namely, root surface debridement. Teeth of hopeless prognosis may be extracted during this initial phase of therapy. The only exception to this broad approach would be in the case of a full dental clearance. Table 1 shows the changes in clinical measurements generally observed following a single course of non-surgical therapy.

As periodontitis can only be stabilised rather than cured and maintains a risk of relapse, decision making can be challenging when determining when it is appropriate to enter a maintenance phase compared with active treatment. Additionally, confusion can arise when considering the various options available

to help achieve periodontal stability. This series of articles aims to outline the pertinent factors to assess at the periodontal reassessment stage and how they can influence future treatment planning. This first article outlines important aspects to assess at the reassessment appointment.

History and examination at reassessment

When to reassess

Due to the progressive nature of periodontitis, the reassessment stage is important in order to assess patient compliance and the outcome of initial treatment, in addition to other factors that can affect disease progression or stabilisation. Patients should be made aware of the nature of periodontitis, including the risk of disease progression following a period of stability, and the subsequent need for ongoing re-evaluation.

Different timescales have been suggested regarding when to carry out the periodontal reassessment after initial therapy. The biggest changes in periodontal probing depths occur up to 3 months following initial therapy and healing at a slower pace occurs for up to 9 months.⁶ In view of this, it has been suggested that reassessment should be carried out at 3 months. A shorter time period has been suggested of between 4 to 8 weeks; the authors' clinical practice involves reassessing at 6 to 8 weeks, for the reasons shown in Box 2.⁷ The factors that require assessing at the reassessment visit will next be discussed.

Updating the history

Any patient complaints should be recorded, in addition to ascertaining the patient's own report of any changes in their periodontal condition. This may give an insight into patient motivation, compliance and the need for further intervention if symptomatic teeth are reported. Periodontitis is often asymptomatic and pain is usually a sign of advanced disease. At this stage, patients often volunteer an indication of how compliant they have been and how they perceive their oral health to be. Comparing patients' reports of plaque control and oral health with clinical findings can help the clinician to gauge patient compliance, understanding and the level at which to target further oral hygiene instruction or treatment options appraisal. Ideally, open questions should be used to engage patients in their own treatment.

Table 1 Clinical changes generally observed after a single course of non-surgical therapy (adapted from Cobb *et al.*)¹⁹

Initial probing depth (mm)	Mean change in probing depth (mm)	Mean change in probing attachment level (mm)	Mean change in recession (mm)
≤3.5	0	-0.5	0.5
4-6.5	1-2	0-1	0-1
≥7	2-3	1-2	1-2

Box 2 Key points to define periodontal reassessment 4-8 weeks following initial therapy

1. Reestablishment of the junctional epithelium to the root surface takes 1-2 weeks; reassessment prior to this is too early
2. Repair of connective tissue occurs for 4-8 weeks following initial therapy
3. Subgingival microbial repopulation occurs 2 months after initial therapy if plaque control is inadequate; waiting longer therefore risks disease progression
4. 4-8 weeks allows adequate time to assess patient's long-term plaque control
5. Bleeding on probing, gingival erythema and oedema decrease during the initial 4-8 weeks post-therapy.

Key points derived from reference⁷



Fig. 2 Generalised gingival oedema and erythema



Fig. 3 Gingival erythema localised to the upper left quadrant at reassessment



Fig. 4 Generalised gingival overgrowth associated with amlodipine use



Fig. 5 Localised gingival epulis between 45 and 46 associated with amlodipine use

The medical history should be updated in order to assess, and where possible minimise, any systemic and local risk factors. Females should be asked about their pregnancy status as this can increase the risk of periodontal disease.⁸ Diabetic patients should be asked how well controlled their diabetes is, via glycosylated haemoglobin levels (Hb1ac), as it can impact on the periodontal disease and response to treatment.

Smoking status, alcohol intake and any changes to lifestyle, for example, stressful events or job changes, that could affect attendance or compliance should also be updated. It is valuable to update the patient's reported current stress level, although arbitrary, asking them to score their stress level out of a maximum score of ten will give an indication as to their perceived level of stress.

Examination at reassessment

General examination

A routine extra-oral examination should be undertaken followed by an intra-oral examination of the soft tissues at each visit, as part of routine oral cancer screening.⁹ An assessment of the hard tissues should also be undertaken, noting any changes such as carious lesions, lost or fractured restorations, cavities and tooth surface loss. Severe crowding and imbrication should be recorded as this can affect the ability to optimise oral hygiene.

Gingival appearance

The gingival appearance should be recorded; gingival erythema and oedema are indicative of inflammation (Fig. 2). At reassessment, this can give a good and fast assessment of the success of initial therapy and patient compliance. Localised erythema and oedema can often be associated with sites where subgingival calculus is present, either due to inadequate instrumentation, poor plaque control or anatomical factors (Fig. 3). Gingival overgrowth (Fig. 4) and the presence of epulis (Fig. 5) can be due to a combination of deposits and systemic modifying factors, for example calcium channel blockers and some anti-epileptic drugs. This overgrowth should reduce with adequate plaque control; however, reassessment may provide an opportunity to liaise with the patient's medical practitioner to consider alternative medications where possible. The visual detection of dark, stained calculus deposits is suggestive of some improvement in gingival oedema, as this indicates that previously subgingival calculus is now evident supragingivally. Where recession and active inflammation is present, an

estimation of the width of keratinised gingivae should be made. Keratinised gingivae is tightly attached to the underlying bone and the keratin is more robust to trauma than the non-keratinised unattached alveolar mucosa. If less than 2 mm of keratinised gingivae is present, it can make cleaning uncomfortable and therefore inadequate, leading to clinical attachment loss and recession as the tissue around the gingival margins is quite thin.^{10,11,12} As the evidence to support this is inconclusive, assessments should be made on a case-by-case basis and in the first instance, recession can of course be monitored rather than undertaking active intervention. In order to identify the mucogingival junction, a periodontal probe should be held horizontally, along the alveolar mucosa and used to roll it up. The distance from the gingival margin to the mucogingival junction shows the width of keratinised gingivae. Additionally, high fraenal attachments in areas where there is little keratinised gingivae can cause similar problems and should be identified (Fig. 6).

Periodontal examination

A full periodontal examination should then be undertaken. This should include a 6-point periodontal pocket chart assessing periodontal probing depths, recession, bleeding on probing, suppuration (if present), mobility and furcation involvement. The periodontal probe can additionally be used to feel for subgingival calculus, root grooves, overhanging restorations and other anatomical factors contributing to or exacerbating periodontal pockets.

During probing, an assessment can be made of the gingival biotype. A simple way to assess gingival biotype is when the probe can be seen through the gingivae it is said to be of a thin biotype; when the probe cannot be seen through the gingivae the biotype is thicker. It is important to assess biotype as patients with a thin biotype have more fragile soft tissues which are more prone to recession and harder to manage surgically whereas a thick gingival biotype can potentially impede pocket resolution. Sometimes it can be difficult to determine exactly which type of biotype the patient has as there may be areas of both types within the same patient.

There is benefit in recording whether bleeding on probing is immediate or delayed, as immediate bleeding suggests ongoing inflammation of the marginal gingivae due to inadequate daily plaque control, whereas delayed bleeding suggests active



Fig. 6 Localised calculus and plaque build-up in addition to recession associated with a high labial fraenal attachment and lack of keratinised gingivae around lower central incisors



Fig. 7 Identifying plaque. (a) Assessment of plaque without disclosing; (b) The same case after disclosing, showing the presence of abundant plaque deposits



Fig. 8 Orthopantomograph showing an unopposed and overerupted upper right third molar (18) with an additional supernumerary and associated bone loss around the distal aspect of the adjacent tooth

inflammation at the base of the pocket or presence of subgingival calculus despite supragingival plaque control. Additionally, disclosing solution can be used and a formal assessment of oral hygiene undertaken, facilitating communication with the patient and aiding motivation. The use of disclosing solution will more easily highlight areas where plaque is present (Fig. 7) and allow an accurate quantitative record of oral hygiene. There are a number of different systems to record the level of plaque control. The use of a full mouth plaque score allows a quick, yet

thorough assessment of the whole mouth. It should focus only on plaque at the gingival margin and is simply recorded as absent or present at six points around each tooth.¹³ It is recorded as a percentage of surfaces where plaque is present. This can be used to assess patient compliance, highlight the cause for localised or generalised signs and symptoms and aid focused, patient specific oral hygiene, targeting specific sites where plaque is still present. These assessments should also have been part of the initial examination and used as a tool to motivate the patient to decrease

plaque scores. For details on how to carry out a thorough initial assessment, we would advise to refer to comprehensive texts by Armitage, Highfield & Pihlstrom, focusing on periodontal assessment and diagnosis.^{14,15,16}

Occlusion

Any unopposed teeth should be recorded as posterior teeth have been shown to have an 82-83% chance of overeruption and a 51% chance of being involved in an occlusal interference.^{17,18} Overeruption has been shown to be more likely in the first few years after opposing tooth loss.¹⁹ Any associated bone loss decreases the prognosis of these teeth and their lack of function or aesthetics, often when coupled with a hindrance of home and professional cleaning of adjacent functional teeth, can thus indicate the need for their removal. This is often the case around third molars (Fig. 8), however, it is essential to assess the position of vital structures, such as the inferior dento-alveolar nerve, before considering extraction of third molars.

Cross-bites and severely crowded teeth should be examined, as well as those involved in an uneven occlusal plane to assess for fremitus if they show continued probing defects. Fremitus is the movement of teeth subjected to functional occlusal forces and can be assessed by holding a finger on the buccal aspect of a tooth as the patient taps their teeth together. This can be an indication of secondary occlusal trauma, related to parafunctional activity. Where bone loss has occurred, consideration can be given to



Fig. 9 Discoloured upper left central incisor with a 12 mm pocket disto-buccally diagnosed with a combined periodontic-endodontic lesion having suffered trauma 6 months previously. (a) Clinical appearance at presentation; (b) Radiographic appearance showing distal bone loss, periapical radiolucency and sclerosed canal complicating the root canal treatment



Fig. 10 Comparison of the diagnostic value of a dental panoramic tomograph versus periapical radiograph in periodontal investigation in the same patient. (a) Dental panoramic tomograph showing localised areas of bone loss; (b) Periapical radiograph showing an intrabony defect on the mesial aspect of the upper left second molar tooth which cannot be clearly identified on the orthopantomogram

occlusal adjustment, however the evidence for this is equivocal.²⁰ Clinical indicators of occlusal trauma can be seen in Box 3.

Apical infection

Any loss of vitality should have been identified at initial examination. Non-vital teeth that were not planned for extraction should either have undergone root canal treatment or the pulp accessed, extirpated

Box 3 Clinical indicators of occlusal trauma

Clinical indicators of occlusal trauma may include one or more of the following:

1. Fremitus
2. Mobility (progressive)
3. Occlusal discrepancies
4. Wear facets in presence of other indicators
5. Tooth migration
6. Fractured tooth/teeth
7. Thermal sensitivity.

Indicators derived from reference²⁰

Box 4 Common factors to assess on radiographic examination of periodontitis

- Bony pathology (for example, cysts, odontomes or tumours)
- Percentage alveolar bone loss around teeth
- Pattern of bone loss: horizontal or vertical (also known as angular)
- Infrabony and intrabony defects: defects affecting the bone and defects within the bone
- Furcation involvement
- Calculus deposits
- Root anatomy: length and shape
- Defective or overhanging restorations
- Periapical radiolucencies
- Radiolucencies indicative of caries.

and dressed with non-setting calcium hydroxide if the prognosis was questionable during initial therapy. Teeth with periapical disease show deeper periodontal probing depths and an approximately three-fold increase in marginal bone loss compared with vital teeth.²¹ Hence, endodontic examination, including percussion, pressure and sensibility (pulp) testing, should be undertaken for teeth of questionable vitality, including those with deep probing depths, furcation involvement and heavily restored teeth. Anterior discoloured teeth, especially in class II division I incisal relationships, may have suffered trauma and warrant further investigation (Fig. 9). This article will not focus on combined periodontic-endodontic lesions and other texts provide this information.

Special investigations

Radiographic investigation should have been undertaken at initial assessment. Whereas a dental panoramic tomograph gives a good

overall view of the dentition, it lacks detail around unresponding sites (Fig. 10). Where there are sites with continued periodontal probing depths above 4 mm and significant bone loss is evident or suspected, radiographs should be considered, if not already available.²² Long cone periapical radiographs are the gold standard for periodontal assessment.²² These will give a more detailed view of the bone and root anatomy and periapical regions. If it seems likely that false pocketing is present, horizontal bitewings may suffice. Vertical bitewings can be uncomfortable for the patient and do not fully show the roots, therefore compromising assessment of the percentage bone loss around the root. Periapical radiographs are specifically indicated where periapical pathosis is suspected, including combined periodontic-endodontic lesions, and have the benefit of showing full root anatomy. This latter aspect can aid treatment planning as short and conical roots will have an impact on tooth prognosis. Box 4 shows common factors relevant to periodontitis to be assessed on radiographs. Figure 11 shows some examples of these.

Cone beam computed tomography (CBCT) scans are being increasingly used in dentistry. Little evidence is available regarding their use in periodontitis and they are rarely indicated in the assessment of periodontitis. They may be indicated where surgery is being considered and uncertainties arise around the association of local factors, for example impacted teeth or pneumatized sinuses, which may contraindicate or influence periodontal surgical options (Fig. 12).²³

Bone sounding has shown accuracy in identifying the bony anatomy around a



Fig. 11 Examples of common radiographic findings in periodontitis. (a) Angular/vertical bone loss of approximately 70% and close approximation of sinus floor to the 17 apex which has drifted mesially; (b) Overhanging restoration associated with up to 90% bone loss and intrabony defect affecting 21 mesially; (c) Horizontal bone loss of approximately 60% affecting 44 and 45; (d) Furcation involvement associated with the lower left first and second molar teeth with angular bone loss; (e) Vertical bone loss and apical radiolucency indicative of combined periodontic-endodontic lesion associated with the lower left third molar tooth; (f) Short conical fused roots and mesial calculus deposits associated with upper right second molar tooth

residual pocket.²⁴ It is useful when planning periodontal surgery or when ascertaining whether the residual pocketing is due to an infrabony defect. The procedure requires administration of local anaesthesia before the periodontal probe is placed in the pocket and pressed firmly to the underlying bone.

A measurement is taken from the gingival margin and repeated at various points around the tooth. This can ascertain the shape of infra-bony defects and how much soft tissue is required for resection by calculating the difference between bone sounding measurements and probing depths.

Summary

Reassessment should be timed to allow a balance between a period of healing and the risk of periodontal disease progression. At reassessment of periodontitis, a systematic approach to gathering information should be undertaken to

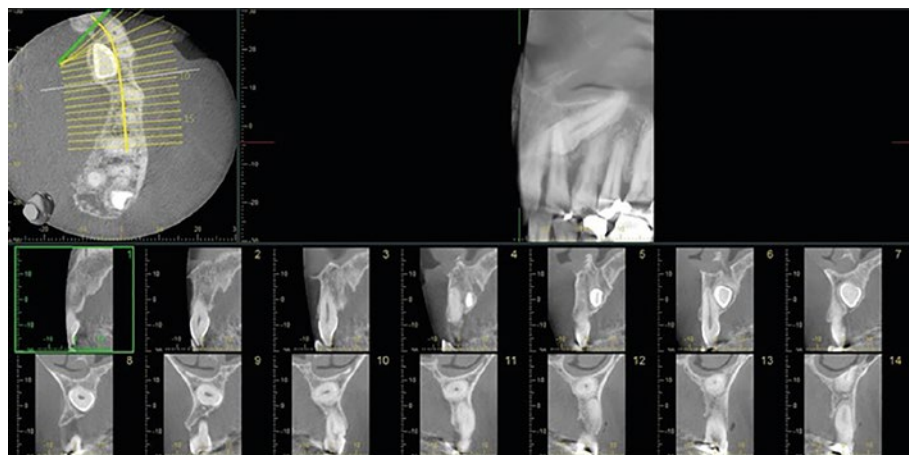


Fig. 12 CBCT scan undertaken to assess relationship between impacted upper left canine and premolar teeth with residual pockets. The presence of a narrow communication shows a potential complicating factor for periodontal surgery and would contraindicate osseous recontouring in this region

update the history and examination, targeted in a way to assess for potential causes of residual probing depths. Gingival appearance, a detailed periodontal examination, occlusal examination and selective special investigations should provide the appropriate information required to assess for potential causes of residual probing depths.

References

1. Periodontology TAAo. *In Glossary of periodontal terms*. Chicago, Illinois: The American Academy of Periodontology, 2001.
2. Caton J G, Armitage G, Berglundh T *et al*. A new classification scheme for periodontal and peri-implant diseases and conditions – Introduction and key changes from the 1999 classification. *J Periodontol* 2018; **89** (Suppl 1): S18.
3. Tonetti M S, Greenwell H, Kornman K S. Staging and grading of periodontitis: Framework and proposal of a new classification and case definition. *J Periodontol* 2018; **89** (Suppl 1): S159s172.
4. Dietrich T, Ower P, Tank M *et al*. Periodontal diagnosis in the context of the 2017 classification system of periodontal diseases and conditions – implementation in clinical practice. *Br Dent J* 2019; **226**: 16–22.
5. Fuller E, Steele J, Watt R, N N. 1: *Oral health and function – a report from the Adult Dental Health Survey 2009*. The NHS Information Centre, 2011.
6. Badersten A, Nilveus R, Egelberg J. Effect of nonsurgical periodontal therapy. I. Moderately advanced periodontitis. *J Clin Periodontol* 1981; **8**: 57–72.
7. Segelnick S L, Weinberg M A. Reevaluation of initial therapy: when is the appropriate time? *J Periodontol* 2006; **77**: 1598–1601.
8. Otomo-Corgel J. Dental management of the female patient. *Periodontology 2000–2013*; **61**: 219–231.
9. Speight P W S, Ogden G. Early detection and prevention of oral cancer. A management strategy for dental practice. *British Dental Association Occasional Paper*, 2010.
10. Lang N P, Loe H. The relationship between the width of keratinized gingiva and gingival health. *J Periodontol* 1972; **43**: 623–627.
11. Smukler H, Machtei E. Gingival recession and plaque control. *Compendium (Newtown, Pa)* 1987; **8**: 194–198.
12. Tonetti M S, Jepsen S. Clinical efficacy of periodontal plastic surgery procedures: consensus report of Group 2 of the 10th European Workshop on Periodontology. *J Clin Periodontol* 2014; **41** (Suppl 15): S36–43.
13. O’Leary T J, Drake R B, Naylor J E. The plaque control record. *J Periodontol* 1972; **43**: 38.
14. Armitage G C. The complete periodontal examination. *Periodontology 2000–2004*; **34**: 22–33.
15. Highfield J. Diagnosis and classification of periodontal disease. *Aust Dent J* 2009; **54** (Suppl 1): S11–26.
16. Pihlstrom B L. Periodontal risk assessment, diagnosis and treatment planning. *Periodontol 2000* 2001; **25**: 37–58.
17. Craddock H L, Youngson C C. A study of the incidence of overeruption and occlusal interferences in unopposed posterior teeth. *Br Dent J* 2004; **196**: 341–348; discussion 337.
18. Kiliaridis S, Lyka I, Friede H, Carlsson G E, Ahlqwist M. Vertical position, rotation, and tipping of molars without antagonists. *Int J Prosthodont* 2000; **13**: 480–486.
19. Compagnon D, Woda A. Supraeruption of the unopposed maxillary first molar. *J Prosthet Dent* 1991; **66**: 29–34.
20. Davies S J, Grey R J, Linden G J, James J A. Occlusal considerations in periodontics. *Br Dent J* 2001; **191**: 597–604.
21. Jansson L, Ehnevid H, Lindskog S, Blomlof L. The influence of endodontic infection on progression of marginal bone loss in periodontitis. *J Clin Periodontol* 1995; **22**: 729–734.
22. Periodontology TBSO. *The good practitioner’s guide to periodontology*. England: The British Society of Periodontology, 2016.
23. Commission E. Radiation Protection No 172 Cone Beam CT for Dental and Maxillofacial Radiology. 2012.
24. Greenberg J, Laster L, Listgarten M A. Transgingival probing as a potential estimator of alveolar bone level. *J Periodontol* 1976; **47**: 514–517.