Periodontal indices

4th grade
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Many indicators have been used in research and clinical studies to measure the prevalence and severity of periodontal diseases. Researchers define what constitutes gingival and periodontal disease by clinical assessment, using measurement scales known as indices (or indexes), which can be defined as an ordinal and arbitrary system of measurement that describes or quantitates a condition. Such indices are appropriate for use in an individual patient or for epidemiological studies.

Or "An index is an expression of the clinical observation in a numerical value. It describes the status of the individual or a group concerning a condition being measured. The use of numerical scale and a standardized method for interpreting observations of a condition results in an index score that is more consistent and less subjective than a word description of that condition". In addition, an index is defined as "A numerical value a describing the relative status of the population on a graduated scale with definite upper and lower limits which are designed to permit and facilitate comparison with other population classified with the same criteria and the method."

• **Dental indices:** are devices to determine the incidence, prevalence and severity of the disease, based on which preventive programs can be adopted.

An index score can be more consistent and less subjective than a word description of the condition.

• **Oral indices:** are essentially sets of values, usually numerical with maximum or minimum limits, used to describe the variables or specific conditions on a graduated scale, which use the same criteria and method to compare a particular variable in individuals, samples or populations.

The characteristics of indices

1. **Reliability**: It measured **consistently** at different time and under varied conditions.
2. **Validity**: It must measure what it is **intended to measure**.
3. **Quantifiability**: should convert observed clinical symptoms into an acceptable numerical form **amenable to statistical analysis**.
4. **Sensitivity**: should be able to **detect reasonably small shift** of the condition.
5. **Clarity, Simplicity and objectivity**: The examiner should be able to **remember** the criteria easily, easily to apply and the criteria should be clear.
6. **Acceptability**: should **not be painful and demeaning** to the subject.
7. **Practicality**: should be **practical** in particular circumstances of the survey.

Assessment of inflammation of the periodontal tissues

Gingival index (GI) (Loe and Silness; 1963)

The presence of inflammation in the gingiva is usually recorded using a probe and often according to the principles outlined by Loe and Silness. The main purpose of the gingival index is for the assessment of the gingival condition, which distinguishes between the quality of the gingiva (severity of the lesion) and the location as related to

the four (buccal, mesial, distal, lingual) areas which make up the total circumference of the marginal gingiva. The gingival index does not consider periodontal pocket depth, degree of bone loss or any other quantitative change of the periodontium; the criteria are entirely confined to qualitative changes in the gingival soft tissue.

The score of GI

- Score 0 Normal gingiva is given when the gingiva is pale pink to pink in color. The surface after drying is matt. The degree of stippling may vary. The gingival margin may be located on the enamel or at various levels apical to CEJ. The form of interdental gingiva depends on the shape and size of interdental areas. The tip of the papilla should be most incisally or occlusally located part of the gingiva. On palpation with the pocket probe, the gingiva should be firm.
- Score 1 Mild inflammation: a slight colour change, slight oedema. A colorless gingival exudate may be observed or collected at the entrance of the crevice. No bleeding on probing.
- Score 2 Moderate inflammation: redness, oedema, and glazing. Bleeding on probing .
- Score 3 Severe inflammation: marked redness and oedema. Ulceration. Tendency to spontaneous bleeding and ulceration.

Method of examination and calculation:

Examination starts with the right upper second molar to the upper left second molar . On the right side, the sequence will be the distal, buccal, and mesial surface. The mesial, buccal, and distal surface is on the left side .The palatal surfaces of all maxillary teeth are assessed, beginning with the upper left second molar by the probe.
Examination of the lower jaw starts with the lower left second molar and is carried through to the lower right second molar .On the teeth of the left side, the sequence will be distal, buccal, and mesial surface. On the right side is the mesial, buccal and distal surface. Finally, all lingual surfaces are scored beginning with the lower left second molar .
Each of the four gingival areas of the tooth is given one score from 0-3, the gingival index for the area. The scores from the four areas of the tooth may be added and divided by four to give the gingival index for the tooth. Finally, by adding the individual scores of the tooth and dividing by the number of teeth examined, the gingival index for the individual is obtained.

Score	Interpretation
0	Healthy
0.1 - 1	Mild inflammation
1.1 – 2	Moderate inflammation
2.1 – 3	Severe inflammation

Modified Gingival Index (MGI)

MGI, devised by Lobene *et al.* (1986), introduced changes in the criteria of the **Gingival Index** (Löe and Silness, 1963) through **a non-invasive (no probing)** and

resetting the rating for mild and moderate inflammation. Gingival units, as well as the calculation of the index, follow the same criteria described in GI.

The scores for MGI

0 = Absence of inflammation
1 = Mild inflammation; slight change in color, little change in texture of any portion of but not the entire marginal or papillary gingival unit
2 = Mild inflammation; criteria as above but involving the entire marginal or papillary gingival unit
3 = Moderate inflammation; glazing, redness, edema, and/ or hypertrophy of the marginal or papillary gingival unit
4 = Severe inflammation; marked redness, edema and/or hypertrophy of the marginal or papillary gingival unit, spontaneous bleeding, congestion, or ulceration

Plaque index (PLI)(Silness and Loe)

Clinical PLI are used to evaluate the level and rate of plaque formation on tooth surfaces and to test the efficacy of oral care products for removing and preventing plaque deposits from these surfaces. This system was introduced by Silness and Loe in 1964 to create a plaque index that would match GI completely.

- Used on all teeth (28, wisdom teeth are excluded) or selected teeth (6 teeth).
- No substitution for any missing tooth.
- Used on all surfaces (4) (M, B, D, Lor P).
- This index measures the plaque thickness on the gingiva of one-third of the teeth.

The scores for PLI

• **0** No plaque

• **1** A film of plaque adhering to the free gingival margin and adjacent area of the tooth, which cannot be seen with the naked eye. But only by using the disclosing solution or by using a probe.

• **2** Moderate accumulation of deposits within the gingival pocket, on the gingival margin and/ or adjacent tooth surface, which can be seen with the naked eye.

• **3** Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin.

Method of examination and calculation:

Scoring requires light, drying of the teeth and gingiva, a mirror, and a probe. If optimal conditions and chair-side assistance are provided, and all teeth are to be examined, scoring according to this system requires approximately 5 minutes. The sequence of the examination for plaque is carried out according to the system described for the GI. **When both GI and PLI are to be used, the assessment of PLI should always precede that of GI**.

Each of the four gingival areas of the tooth is given a score from 0-3; this is the PLI for the area. The scores from the four areas of the tooth may be added and divided by four to give the PLI for the tooth. The scores for individual teeth (incisors, premolars, and molars) may be grouped to designate the PLI for the groups of teeth. Finally, by

adding the indices for the teeth and dividing by the number of teeth examined, the PLI for the individual is obtained.
Thus, PLI scores consider only differences as the thickness of the soft deposit in the gingival area of the tooth surfaces, and no attention is paid to the coronal extension of the plaque.
The assessment of plaque is made on top of calculus deposits, fillings and crowns. Since the gingival area constitutes the unit, the PLI may be scored for all surfaces or selected teeth or areas of all or selected teeth.

Bleeding on probing (BOP) index (Ainamo & Bay,1975)
Because of the subjective nature of many of the earlier indices and observations that bleeding is a reliable indicator of gingival inflammation, simply used the presence or absence of bleeding on gentle probing as the only criterion for index.
BOP is a valuable diagnosis of gingival inflammation as it precedes even the color change due to inflammation and indicates that there is active tissue destruction, absence of BOP is an excellent negative predictor of future attachment loss .

Method of examination:
A blunt periodontal probe is passed into the gingival crevice at six separated points (it is performed through gentle probing of about **25g**). A positive score is given if bleeding occurs within **10 to 15 seconds**. The number of positive units is divided by the number of gingival margins examined, and the result is multiplied by 100 to express the index as a percentage.
This index has been adopted with relatively high reliability in several epidemiological and clinical studies .Bleeding can also function as a motivating factor in activating the patient to better oral home care. It has been shown that the scores obtained with this index correlate significantly to GI (Löe and Silness, 1963) and have been used in profile studies and short-term clinical trials.
Bleeding after gentle probing to the base of the probable pocket has been a common way of establishing the occurrence of subgingival inflammation, characterized by an inflammatory infiltrate adjacent to the ulcerated pocket epithelium.
The scores for BOP:
0. No bleeding occurs after probing.
1. Bleeding emerges within 15 seconds after probing.


Calculate a percentage score for the whole mouth as follows:
% BOP score= Number of surfaces with bleeding X 100/ Total number of teeth X **6**

Plaque index (O'Leary TJ et al. 1972)

The Plaque Control Record was developed to give the therapist, hygienist, or dental educator a simple method of recording the presence of plaque on individual tooth surfaces (mesial, distal, facial, lingual). The form also allows the patient to visualize his learning of plaque control. This seems to have a motivating effect on patients.

Visible plaque is recorded on each tooth's interproximal, facial, and lingual surfaces.

The primary advantage of this index is that a percentage of surfaces covered with plaque may be calculated and compared at subsequent appointments.

The major disadvantage is that collecting the data takes between 5 to 7 minutes.

The scores for PI:

- 0 = no plaque (left blank)
- 1 = plaque present (recorded √)

Method of examination and calculation:

A suitable disclosing solution, such as Bismarck Brown, is painted on all exposed tooth surfaces. After the patient has rinsed, the operator uses an explorer or probe tip to examine each stained surface for soft accumulations at the dentogingival junction. When found, they are recorded by dashing the appropriate spaces on the record form. Those surfaces with soft accumulations not at the dentogingival junction are not recorded.

After all teeth are examined and scored, an index can be derived by dividing the number of plaque-containing surfaces by the total number of available surfaces. The same procedure is carried out at subsequent appointments to determine the patient's progress in learning and carrying out the prescribed oral hygiene procedures. By the third or fourth assessment, the number of surfaces with plaque accumulations is normally reduced to the point that the procedure can be carried out in (3-4) minutes.

Our goal in teaching oral hygiene procedures is to reduce plaque accumulations until they are found on **10% or less** of the available tooth surfaces; the amount of plaque found on these remaining surfaces is usually markedly reduced by this time.

Surgical therapy is not initiated until the patient reaches the approximate 10% level. If, after three or four appointments, it is seen that the patient is not motivated to carry out the necessary procedures, treatment is either terminated or the treatment plan is drastically revised.

Calculate the % of plaque as follows:

% **PI** score= Number of surfaces with **Plaque** X 100/ Total number of teeth X **4**

Calculus Index (CI) (John C.Greene and Vermillion in;1960)

Calculus is mineralized material on the tooth surface. The calculus index refers to the amount of calculus on a tooth. It is a part of the **Oral Hygiene Index (composed of the Debris Index and Calculus Index)**. It was depicted as a sensitive, simple method for quantitatively assessing group or individual oral hygiene. It is a useful epidemiological tool. It is used in surveys to assess toothbrushing and oral hygiene programs. It is widely used for evaluating community dental health programs.

The scores for CI

0 — No observable calculus.

1 — Scattered calculus covering less than one-third of the buccal tooth surface.

2 — Calculus covering between one- and two-thirds of the buccal tooth surface with minimal subgingival deposition.

3 — Calculus covers over two-thirds of the buccal tooth surface and extends sub-gingivally.

Method of examination and calculation:

The mouth is divided into 6 sextants: 18-14; 13-23; 24-28; 38-34; 33-43; 44-48. Only fully erupted permanent teeth (the third molars and incompletely erupted teeth) are scored .

Calculus scores are taken on the tooth in a segment having the greatest surface area covered by supragingival and sub-gingival calculus .Calculus is estimated by running a probe, on the **buccal/labial or lingual surface**, noting the occlusal or incisal extent of the debris as it is removed from the tooth surface .

The scores of (CI)=Total calculus score recorded /No. of segments scored

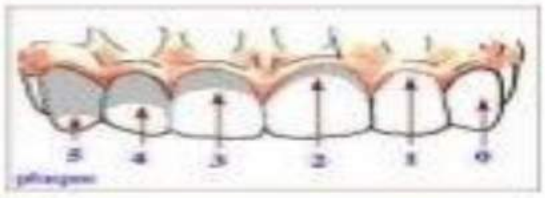
Plaque index (Quigely Hein; 1962)

An index that evaluates the plaque revealed on the teeth' **buccal/labial and lingual non-restored surfaces** on a scale of 0 to 5, defined by Quigley and Hein in 1962 and modified by **S. Turesky, N. D. Gilmore, and I. Glickman in 1970**. All teeth except the third molars are assessed, and an index for the entire mouth is determined by dividing the total score by the number of surfaces examined.

SCORING CRITERIA:

QUIGLEY AND HEIN

Score	Criteria
0	no plaque
1	flecks of stain of the gingival margin
2	Definitive line of plaque on gingival margin
3	Gingival third of surface
4	Two- thirds of surface
5	Greater then 2/3rd of the surface



TURESKY et al

SCORE	CRITERIA
0	No plaque
1	Separate flecks of plaque at the cervical margin of the tooth
2	A thin continuous band of plaque at the cervical margin of the tooth
3	A band of plaque wider then 1mm covering less than 1/3rd of the crown of the tooth
4	Plaque covering at least 1/3rd but less then 2/3rd of the crown of the tooth
5	Plaque covering 2/3rd or more of the crown of the tooth

Assessment of loss of periodontal tissue support

The sulcus depth usually remains at 1–3 mm, irrespective of the clinical attachment level. Pseudopocketǁ may be present in cases of slightly increased probing depth without concomitant attachment, alveolar bone loss, and presence/absence of BOP.

Signs of destructive changes in periodontal tissues are as follows:

1. Attachment loss.
2. Periodontal pocket (depth of probing more than 4 mm), suppuration.
3. Tooth mobility.
4. Pathological migration of the teeth (fan-shaped divergence).

Pocket Depth and Loss of Attachment index were given **by Glavind and Loe (1967).** Russell's PI and Ramfjord's PDI have qualitative and quantitative criteria and a gingival and periodontal component. The pocket depth and attachment loss concerning the CEJ as a fixed point of reference are expressed in millimeters. The criteria of pocket depth and loss of attachment measurements are defined as follows.

Periodontal Pockets Depth (PPD)

This is the distance between the base of the pocket and the gingival margin. Mesial and distal pockets are measured from the buccal aspect and as close as possible to the contact points. Facial and lingual/palatal pockets were measured at the midline of the roots. To avoid the furcation areas, the buccal and lingual/palatal pockets of multi-rooted teeth were measured at the mesial roots. Efforts were made to insert the probe parallel to the axis of the roots.

Detection of Pockets

The only accurate method of detecting and measuring periodontal pockets is carefully exploring with a periodontal probe. Pockets are not detected by radiographic examination. The periodontal pocket is a soft tissue change. Radiographs indicate areas of bone loss where pockets may be suspected, but they do not show pocket presence or depth.

Assessment of PPD.

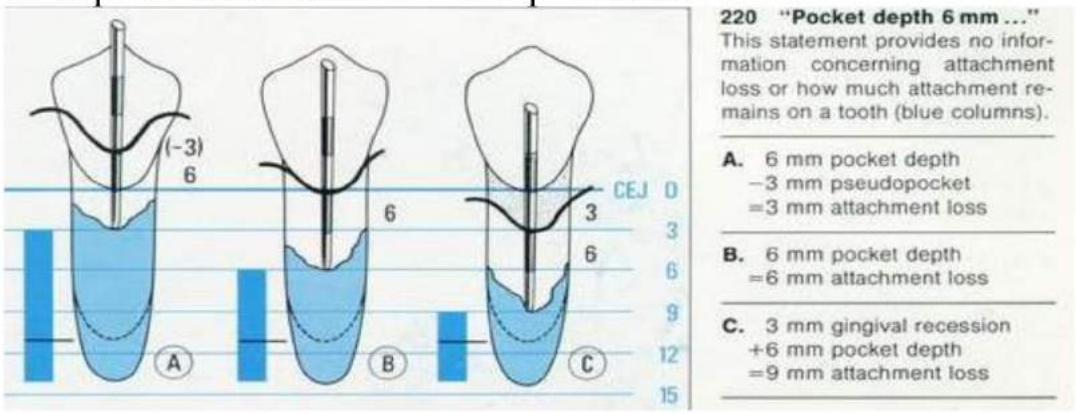
For effective treatment planning, the location, topography, and extent of periodontal lesions must be recognized in all parts of the dentition. It is, therefore, mandatory to examine all sites of all teeth for the presence or absence of periodontal lesions. The probe should be inserted parallel to the vertical axis of the tooth and "walked" circumferentially around each tooth's surface to detect the areas of deepest penetration. Single-rooted teeth must be examined at at least four sites (e.g. mesial, buccal, distal, and oral). Multirooted teeth at six sites at least (e.g. mesiobuccally, buccal, distobuccal, distooral, oral, and mesiooral). The probing depth, the distance from the gingival margin to the bottom of the gingival sulcus/pocket, is measured to the nearest millimetre using a graduated periodontal probe.

Probe penetration can vary depending on the following:

- The force of introduction.
- The shape and size of the probe tip.
- The direction of penetration
- Resistance of the tissues.
- Convexity of the crown.
- The degree of tissue inflammation

Clinical Attachment Level

The level of attachment is the distance between the base of the pocket and a fixed point on the crown as the cementoenamel junction (CEJ). Changes in the level of attachment can result from gain or loss of attachment and afford a better indication of the degree of periodontal destruction or improvement.

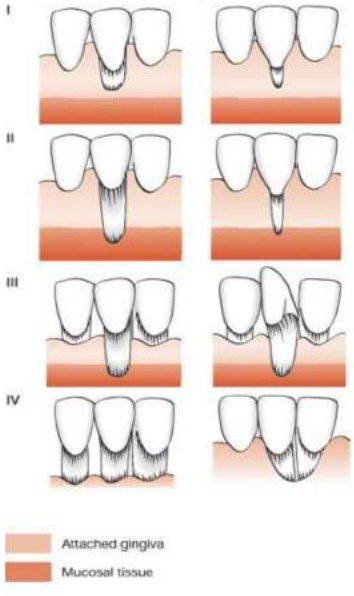


Interdental crater: to detect this area, the probe should be placed obliquely from both the facial and lingual surfaces to explore the deepest pocket point beneath the contact point.

Gingival recession (GR)

It is defined as "the displacement of marginal tissue apical to CEJ". Most of the classifications of GR are unable to convey all the relevant information related to marginal tissue recession. This information is important for shaping diagnosis, prognosis treatment planning, and clinician communication .Several classifications have been proposed to facilitate the diagnosis of GR. They are as follows:

•Sullivan and Atkins (1968) • Mlinek (1973) • Liu and Solt (1980) • Bengue (1983)
•Miller (1985) • Smith (1990) • Nordland and Tarnow (1998) • Mahajan (2010)
•Cairo et al. (2011) • Rotundo et al. (2011) • Ashish Kumar and Masamatti (2013)
•Prashant et al .(2014) .



Miller, in 1985, classified GR based on:

A. Extent of GR defects

B. Extent of hard and soft tissue loss in interdental areas surrounding GR defects .

Its significance lies in that it is useful in predicting the final amount of root coverage following a free gingival graft procedure.

Four types of GR defects were **categorized as follows**:

Class I: recession not extending to the MGJ; no interdental bone loss. (100% root coverage)

- **Class II**: recession extending to or beyond the MGJ; no interdental bone loss. (100% root coverage)
- **Class III**: recession extending to or beyond the MGJ; interdental bone loss or mispositioning of the tooth (50% to 70%)

- **Class IV**: recession extending to or beyond the MGJ; severe interdental bone loss or severe mispositioning of the tooth. (≤ 10%)

Limitations of Miller's classification of GR:

1. The reference point for classification is MGJ: The difficulty in identifying MGJ creates difficulties between Class I and II. There is no mention of the presence of keratinized tissue.
2. In Class III and IV, the interdental bone or soft tissue loss is an important criterion to categorize the recessions. The amount and type of bone loss have not been specified. Mentioning Miller's Class III and IV does not exactly specify the level of interdental papilla and the amount of loss. A clear picture of the severity of the recession is hard to project.
3. Class III and IV categories stated that marginal recession extends to or beyond the MGJ with the loss of interdental bone or soft tissue apical to the CEJ; The cases which have interproximal bone loss and the marginal recession does not extend to MGJ cannot be classified either in Class I because of interproximal bone or in Class III because the gingival margin does not extend to MGJ.
4. The difference between Class III and IV is based on the position of the gingival margin of the two adjacent teeth; Class III and Class IV can be identified if there are adjacent teeth; however, in the case of a missing adjacent tooth, there is no reference point, and it is impossible to include this case in Class III or IV.
5. It does not specify the marginal tissue's facial or lingual involvement.
6. According to Miller's classification, the recession of interdental papilla alone cannot be classified. It requires the use of an additional classification system.
7. Classification of the recession on the palatal aspect is another concern: The difficulty of the applicability of Miller's criteria on the palatal aspect of the maxillary arch can be reasoned out to the fact that there is no MGJ on the palatal aspect.
8. It estimates the prognosis of root coverage following the grafting procedure. Miller stated that 100% coverage can be anticipated in Class I and II, partial root coverage in Class III and no root coverage in Class IV.

Cairo et al. 2011 suggested the classification of GR

Classified GR based on the assessment of CAL at both **buccal and interproximal sites**. It provides a simplified method of categorizing GR and emphasizes the role of interproximal CAL, one of the important siterelated prognostic factors. However, it does not consider the remaining width of the attached gingiva, the relationship between gingival margin and MGJ, which play a very important role and govern the choice of treatment procedure, and tooth malposition, which greatly affects the treatment outcome.

Buccal recession type 1 without interproximal attachment loss.

Buccal recession type 2 is associated with interproximal attachment loss less than or equal to the buccal attachment loss.

Buccal recession type 3 is related to interproximal attachment loss greater than buccal attachment loss.

Furcation involvement (Glickman,1953)

A furcation is "the anatomic area of a multirooted tooth where the roots diverge", and furcation invasion refers to the "pathologic resorption of bone within a furcation. Several systems have been proposed based either on the extent of horizontal probing depth into the furcation defect or on the vertical extent of the loss of alveolar bone within the defect. Using specially designed probes allows an easier and more accurate exploration of the horizontal component of furcation lesions.

Classified into four grades:

GI: Horizontal loss of supporting tissues not exceeding 1\3 of tooth width.

G2: Horizontal loss of supporting tissues exceeding 1\3 of tooth width but not including the total width of furcation area.

G3 – Through and through destruction of tissues in the furcation area, but gingival tissues occlude the orifices.

G4- Through-and-through lesion with gingival recession, leading to a clearly visible furcation area.

Basic Periodontal Examination (BPE) Index

It was developed by the **British Society of Periodontology (BSP) in 1986** and revised in 2011. Careful assessment of the periodontal tissues is an essential component of patient management. The BPE is a simple and rapid screening tool used to indicate the level of examination needed and provide basic guidance on treatment needs. BPE does not provide a diagnosis and is derived from the **Community Periodontal Index of Treatment Needs (CPITN).**

Method of examination

1. The dentition is divided into six sextants:

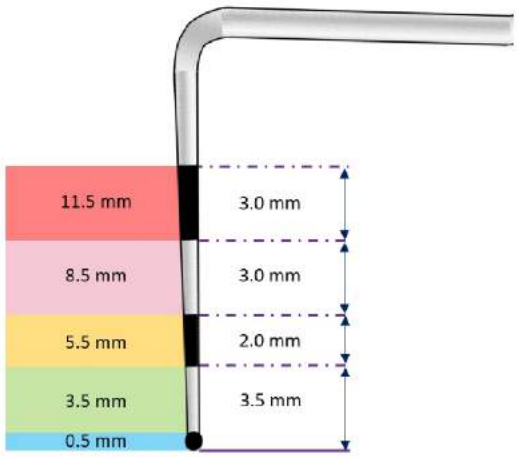
upper right (17 to 14), upper anterior (13 to 23), upper left (24 to 27)
lower right (47 to 44), lower anterior (43 to 33), lower left (34 to 37)

17-14	13-23	24-27
47-44	43-33	34-37

2. All teeth in each sextant are examined (except 3rd molars).

3. For a sextant to qualify for recording, it must contain at least two teeth. (If only one tooth is present in a sextant, the score for that tooth is included in the recording for the adjoining sextant).

4. A WHO BPE probe (World Health Organization probe) is used. This has a "ball end" 0.5 mm in diameter and a black band from 3.5 to 5.5 mm. When probing the periodontal tissues, light probing force should be used (20-25 grams), equivalent to the force required to blanch a fingernail.
5. The probe should be "walked around" the sulcus/pockets in each sextant, and the highest score should be recorded. As soon as code 4 is identified in a sextant, the clinician may move directly on to the next sextant, though it is better to continue examining all sites in the sextant. This will help understand the periodontal condition better and ensure that furcation involvements are not missed. If code 4 is not detected, all sites should be examined to ensure that the highest score in the sextant is recorded before moving on to the next sextant.



Scoring codes

0 No pockets >3.5 mm, no calculus/overhangs, no bleeding after probing (black band completely visible).

1 No pockets >3.5 mm, no calculus/overhangs, but bleeding after probing (black band completely visible).

2 No pockets >3.5 mm, but supra- or subgingival calculus/overhangs (black band completely visible).

3 Probing depth 3.5-5.5 mm (black band partially visible, indicating pocket of 4-5 mm).

4 Probing depth >5.5 mm (black band entirely within the pocket, indicating a pocket of 6 mm or more).

* Furcation involvement.

The number and the * should be recorded if a furcation is detected - e.g., the score for a sextant could be 3* (e.g. indicating probing depth 3.5-5.5 mm PLUS furcation involvement in the sextant).

An example BPE score grid might look like this:

2	1	X
3	2	4*

When to record the BPE

• All new patients should have the BPE recorded.
• For patients with codes 0, 1, or 2, the BPE should be recorded at least annually.
• For patients with BPE codes of 3 or 4, more detailed periodontal charting is required:
- Code 3: record full probing depths (6 sites per tooth) in the sextant(s) where code 3 was recorded, in addition to recording the BPE in those sextants with scores 0, 1, or 2
- Code 4: if there is a code 4 in any sextant, then record full probing depths (6 sites per tooth) throughout the entire dentition.
• BPE cannot be used to assess the response to periodontal therapy because it does not provide information about how sites within a sextant change after treatment. To determine the response to treatment, probing depths should be recorded at six sites per tooth pre- and post-treatment.
• For patients who have undergone initial therapy for periodontitis (i.e., who had pretreatment BPE scores of 3 or 4) and are now in the maintenance phase of care, then full probing depths throughout the dentition should be recorded at least annually.

Guidance on the interpretation of BPE scores

Interpreting the BPE score depends on many factors that are unique to each patient. Clinicians should use their skills, knowledge, and judgment when interpreting BPE scores. General guidance is indicated below. The BPE scores should be considered together with other factors when deciding whether to refer (as outlined in the companion BSP document "Referral Policy and Parameters of Care").

0 No need for periodontal treatment
1 Oral hygiene instruction (OHI)
2 OHI, removal of plaque retentive factors, including all supra & subgingival calculus.
3 OHI, root surface debridement (RSD)
4 OHI, RSD. Assess the need for more complex treatment; referral to a specialist may be indicated.
***** OHI, RSD. Assess the need for more complex treatment; referral to a specialist may be indicated.