PERIODONTAL INDICES

An Index: can be defined as an ordinal and arbitrary system of measurement which 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 is used to describe the status of the individual or a group with respect to 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"- **Esther M Wilkins.**

According to **Russell A.L**, 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 is designed to permit and facilitate comparison with other population classified with the same criteria and the method"

- **Dental index or indices:** are devices to find out 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 set of values, usually numerical with maximum or minimum limits, used to describe the variables or a specific conditions on a graduated scale, which use the same criteria and method to compare a specific variable in individuals, samples or populations. **("George P Barnes" -1985).**

✓ Ideal Requisites of an Index:

Clarity
- Rules of the index should be clear
- Rules of the index should be easy to remember
- The categories should be clearly demarcated and should make a decision making easy

Simplicity
- Simple
- Easy to apply

Objectivity
- The criteria should be objective
- The criteria should be unambiguous
- The criteria should be mutually exclusive
- The criteria should not be susceptible to examiner's opinion

Validity
- It should measure what is intended to measure

Reliability & Producibility
- It should measure consistently
- It should be producible and give the same result if the assessed condition is unchanged

Quantifiability
- It should convert observed clinical symptoms into an acceptable numerical form amenable to statistical analysis

Sensitivity
- It should be able to detect reasonably small shifts
- It should be able to measure changes in either direction

Acceptability
- It should not be painful to the subjects
- It should be free of discomfort for the subjects
- It should not be demeaning to the subjects

Gingival Index (GI): was given by **Harold Loe and Silness 1963**. 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.

Score 0: 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 pocket probe, the gingiva should be firm.

Score 1: is the score given when the gingiva is subject to mild inflammation. The gingival margin is slightly more reddish or bluish red than normal, and there is slight edema of the margin. A colorless gingival exudate may be observed or collected at the entrance of the crevice. Bleeding is not provoked when the probe is run along the soft tissue wall of the entrance of the gingival crevice.

Score 2: This is the score for a moderately inflamed gingiva. The gingiva is red or reddish blue and glazy. There is enlargement of the margin due to edema. Bleeding is provoked when the probe is run along the soft tissue of the wall of the gingival crevice.

Score 3: is the score for severe inflammation. The gingiva is markedly red or reddish blue and enlarged. Tendency for spontaneous bleeding and ulceration.

Armamentarium:

♦ Mouth mirror ♦ Periodontal probe ♦ Tweezer ♦ Kidney trays ♦ Cotton

Method of Examination

♦ Examination starts with the right upper second molar, is continued over the midline to the upper left second molar.

♦ On the right side, the sequence will be the distal, buccal, and mesial surface.

♦ On the left side, it is the mesial, buccal and distal surface.

♦ The palatal surfaces of all maxillary teeth are assessed beginning with the upper left second molar.

♦ 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, mesial surface

♦ On those of the right side, it is the mesial, buccal and distal surface.

♦ Finally, all lingual surfaces are scored beginning with the lower left second molar.

- ✓ **Calculation of the Index:**

Each of the four gingival areas of the tooth is given one score from 0-3, this is 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	Criteria of scoring	
0	Normal gingiva	
1	Mild inflammation	Slight change in color, slight edema. No change on probing
2	Moderate inflammation	Redness, edema and glazing. Bleeding on probing
3	Severe inflammation	Marked redness, edema and ulceration. Tendency to spontaneous bleeding

Interpretation of scores:

Score	Interpretation
0.1 - 1.0	Mild inflammation
1.1 – 2.0	Moderate inflammation
2.1 – 3.0	Severe inflammation

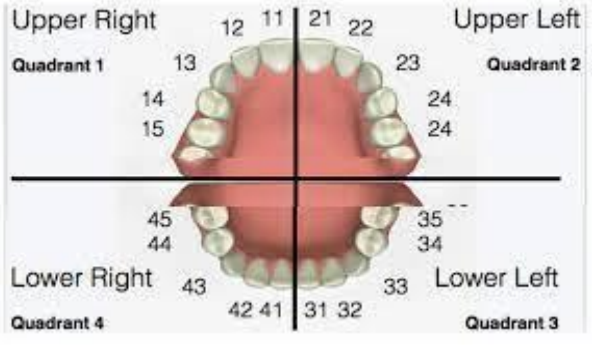
- **Modified Gingival Index (MGI):** assess the prevalence and severity of gingivitis. The Modified Gingival Index (MGI), devised by **Lobene et al. (1986)**, introduced changes in the criteria of the Gingival Index (Löe and Silness, 1963) through:

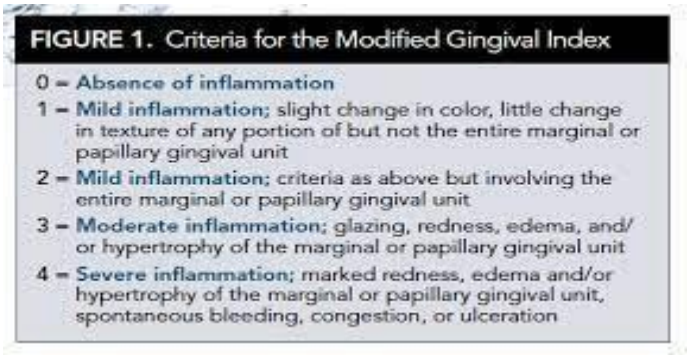
a. A non-invasive (no probing)

b. Resetting the rating for mild and moderate inflammation. In this way, the following criteria are adopted:

Score	Criteria
0	Absence of inflammation
1	Mild inflammation or with slight changes in color and texture but not in all portions of gingival marginal or papillary
2	Mild inflammation, such as the preceding criteria, in all portions of gingival marginal or papillary
3	Moderate, bright surface inflammation, erythema, edema and/or hypertrophy of gingival marginal or papillary
4	Severe inflammation: erythema, edema and/or marginal gingival hypertrophy of the unit or spontaneous bleeding, papillary, congestion or ulceration

- ✓ Gingival units as well as the calculation of the index follow the same criteria described in GI





- **Plaque Index (PLI) (Silness and Löe, 1964):** is fundamentally based on the same principle as the gingival Index, namely the desirability of distinguishing clearly between the severity and the location of the soft debris aggregates. The purpose of introducing this system by

(Silness and Löe,1964) was also to create a plaque index which would match the Gingival Index 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, L or P)
- This index measures **the thickness of plaque on the gingival one third** of the teeth.

❖ **The criteria for Plaque Index system:**

Score	Scoring criteria
0	No plaque in the gingival area
1	A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may only be recognized by running a probe across the tooth surface.
2	Moderate accumulation of soft deposits within the gingival pockets, on the gingival margin and/or adjacent tooth surface, which can be seen by the naked eye.
3	Abundance of soft matter within the gingival pocket and/or on the gingival margin and adjacent tooth surface

PI = 0: This score is given when the gingival area of the tooth surface is free of plaque. The surface is tested by running a pointed probe across the tooth surface at the entrance of the gingival crevice after the tooth has been properly dried, and if no soft matter adheres to the point of the probe, the area is considered clean.

PI = 1: This score is given when no plaque can be observed in situ by the unarmed eye, but when the plaque is made visible on the point of the probe after this has been moved across the tooth surface at the entrance of the gingival crevice. Disclosing may be useful for the recognition of this film of plaque.

PI = 2: This score is given when the gingival area is covered with a thin to moderately thick layer of plaque. The deposit is visible to the naked eye.

PI = 3: Heavy accumulation of soft matter, the thickness of which fills out the niche produced by the gingival margin and the tooth surface. The interdental area is stuffed with soft debris.}}

Method of examination and calculation:

Scoring requires light, drying of the teeth and gingiva, 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 Gingival Index. When both GI and PLI are to be used, 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, the Plaque Index scores consider only differences as to 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, on fillings and crowns. Since the gingival area constitutes the unit, the PLI may be scored for all surfaces of all or selected teeth or selected areas of all or selected teeth.

O'Leary 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 own progress in learning plaque control. This seems to have a motivating effect on patients.

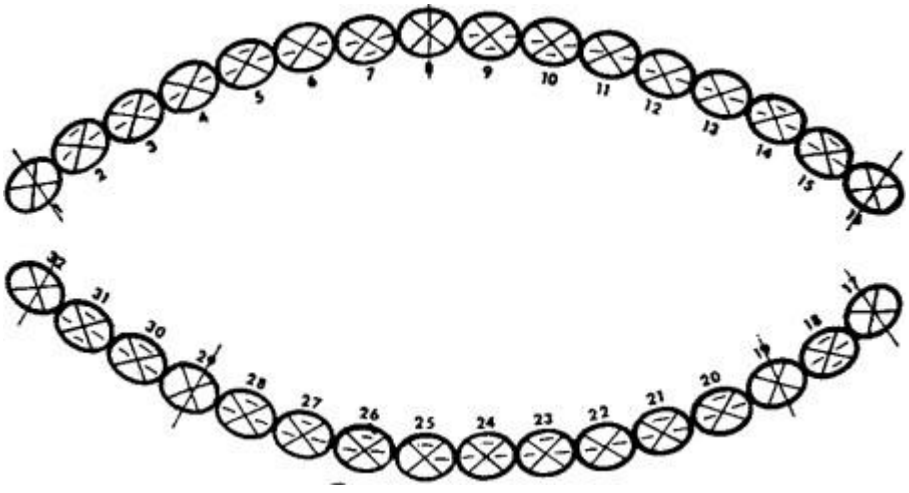
Visible plaque is recorded on the interproximal, facial, and lingual surfaces of each tooth present. The primary advantage of this index is that a percentage of surfaces covered with plaque may be calculated and compared at subsequent appointments. The major disadvantage is that it takes between 5 to 7 minutes to collect the data.

Score	Criteria
0	Absence (No plaque)
1	Presence (There is a dental plaque)

✓ **Method of examination and calculation:**

At the initial control appointment, a suitable disclosing solution such as Bismarck Brown is painted on all exposed tooth surfaces. After the patient has rinsed, the operator using an explorer or the tip of a probe to examine each stained surface for soft accumulations at the dentogingival junction. When found, they are recorded by making a dash in the appropriate spaces on the record form. Those surfaces which have 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 time of 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.

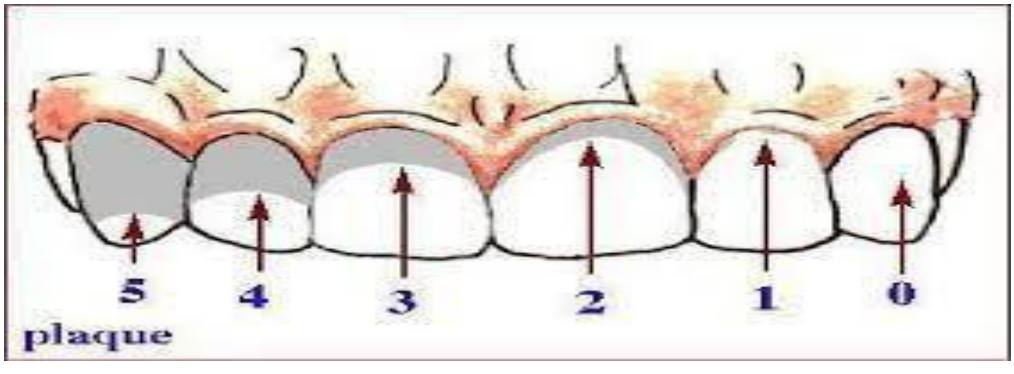


Quigley-Hein Plaque Index: (G. A. Quigley and J. W. Hein in 1962)

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

✓ **The criteria of Quigley–Hain plaque index:**

Score	Scoring criteria
0	No plaque
1	Isolated flecks of plaque at the gingival margin
2	A continuous band of plaque up to 1mm at the gingival margin
3	Plaque greater than 1mm in width and covering up to one third of the tooth surface
4	Plaque covering from one thirds to two thirds of the tooth surface
5	Plaque covering more than two thirds of the tooth surface



Calculus index:

it is a part of Oral Hygiene Index that was introduced by **John C.Greene and Vermillion in 1960** (which is composed of Debris Index and Calculus Index) .

✓ Rules:

• Mouth is divided into 6 sextants as follows: 18-14; 13-23; 24-28; 38-34; 33-43; 44-48

• Only fully erupted permanent teeth excepting (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 buccal/labial or lingual surface noting occlusal or incisal extent of the debris as it is removed from the tooth surface.

✓ Calculation:

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

✓ Advantages:

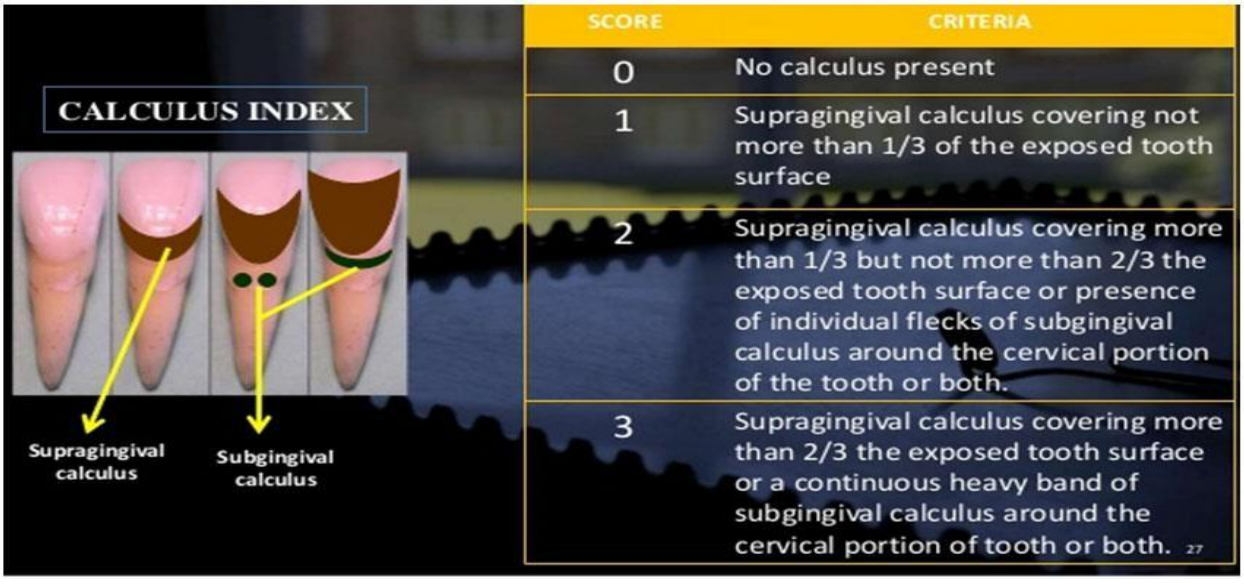
♦ It was depicted as sensitive, simple method for assessing group or individual oral hygiene quantitatively.

♦ 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

✓ **Criteria of Calculus Index:**

Score	Scoring criteria
0	No calculus
1	Supragingival calculus covering not more than 1/3 of the exposed tooth surface
2	a- Supragingival covering more than 1/3, but not more than 2/3 of the exposed tooth surface, or b- The presence of individual flecks of subgingival calculus around the cervical portion of the tooth or both
3	a- Supragingival calculus covering more than 2/3rd of the exposed tooth surface or b- A continuous heavy band of subgingival calculus around the cervical portion of the tooth, or both.



Bleeding On Probing Index (BOP): It was developed by **(Ainamo & Bay,1975).**

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

- ✓ **Method of examination:**

Blunt periodontal probe is passed into the gingival crevice at six separated points (is performed through gentle probing about 25g) and if bleeding occurs within 10 to 15 seconds, a positive score is given. 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 in several epidemiological and clinical studies with a relatively high degree of reliability.

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 has been used in profile studies and short-term clinical trials.

Score	Scoring criteria
0	**Absence of bleeding**
1	**Presence of bleeding**

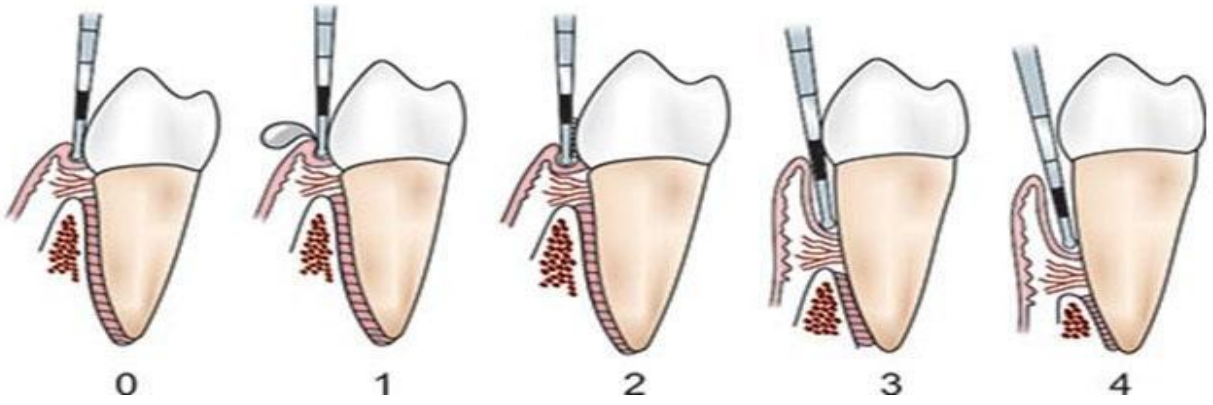
Pocket Depth and Loss of Attachment:

This index was given by **Glavind and Loe (1967).** Both Russell's PI and Ramfjord's PDI have qualitative and quantitative criteria and a gingival and periodontal component. The pocket depth and loss of attachment in relation to 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.

Pocket depth: It refers to the distance from **the gingival margin to the bottom of the clinical pocket**. 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. Buccal and lingual/palatal pockets of multi-rooted teeth were measured at the mesial roots to avoid the furcation areas. Efforts were made to insert the probe parallel to the axis of the roots. A force of approximately 10 grams was used during the introduction of the probe to the bottom of the pocket.

Clinical Attachment Level: It refers to the distance from the **CEJ to the bottom of the clinical pocket**. The loss of attachment was assessed on the same surfaces of the same teeth and with the same probe as used for pocket depth assessments. Following the recognition of the CEJ, the distance from the gingival margin to the CEJ was measured.

- When the CEJ was located apical to the gingival margin, the loss of attachment would be the difference between the previously recorded depth of the pocket (A) and the distance (B) from the gingival margin to the CEJ: A – B = loss of attachment.
- In cases where the marginal gingiva had been subject to recession and the CEJ was exposed, the loss of attachment equaled the sum of the pocket depth and the distance from the gingival margin to the CEJ: A + B = loss of attachment.
- The measurements were carried out with a 0.8 mm thick periodontal pocket probe which was marked at each mm from 1 to 12.



Gingival recession: is defined as "the displacement of marginal tissue apical to the cementoenamel junction (CEJ)". To categorize gingival recession, various classifications have been proposed. Most of the classifications of gingival recession are unable to convey all the relevant information related to marginal tissue recession. This information is important not only for shaping diagnosis, prognosis and treatment planning but also communication between clinicians.

Several classifications have been proposed in literature to facilitate the diagnosis of gingival recessions. 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's classification of gingival recession 1985: Miller proposed a classification system in 1985 and is probably still most widely used system for describing the gingival recession. He has primarily based his classification of gingival recession defects on the following aspects:

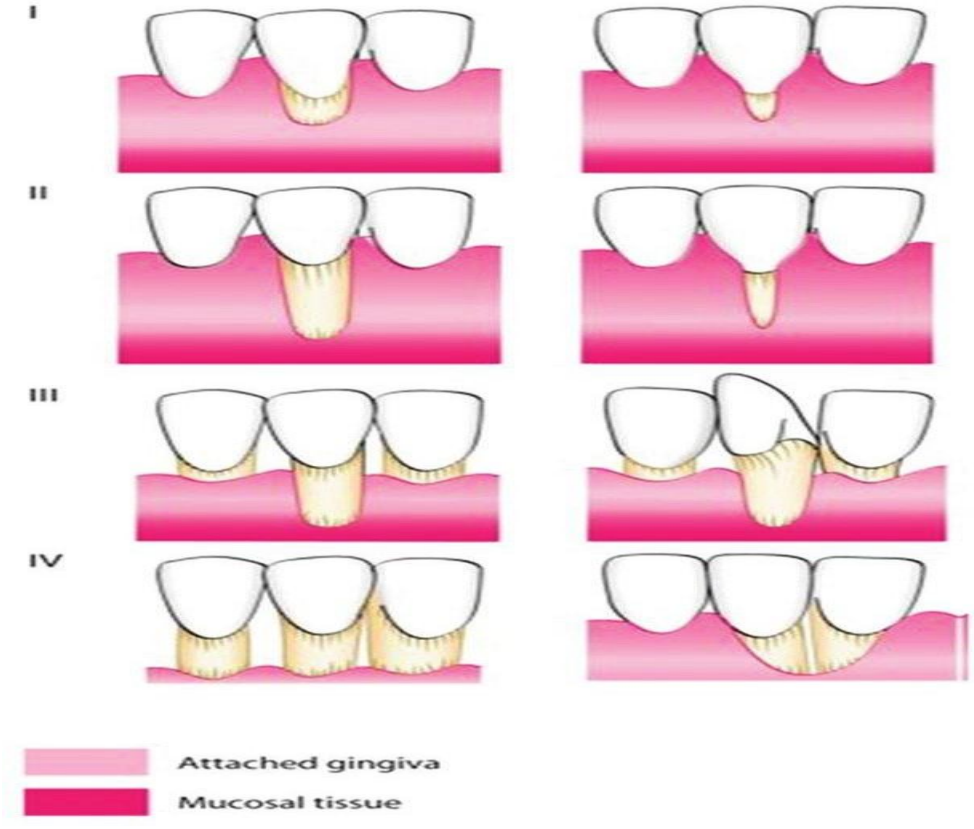
A. Extent of gingival recession defects

B. Extent of hard and soft tissue loss in interdental areas surrounding the gingival recession defects.

Its significance lies in the fact that it is useful in predicting the final amount of root coverage following a free gingival graft procedure. Four types of recession defects were categorized as follow:

Class no.	Class criteria
Class I	Marginal tissue recession, which does not extend to the mucogingival junction (MGJ). There is no periodontal loss (bone or soft tissue) in the interdental area, and 100% root coverage can be anticipated
Class II	Marginal tissue recession, which extends to or beyond the MGJ. There is no periodontal loss(bone or soft tissue) in the interdental area, and 100% root coverage can be anticipated
Class III	Marginal tissue recession, which extends to or beyond the MGJ. Bone or soft tissue loss in the interdental area is present or there is a mispositioning of the teeth, which prevents the attempting of 100% of root coverage. Partial root coverage can be anticipated. The amount of root coverage can be determined presurgically using a periodontal probe

Class IV	Marginal tissue recession, which extends to or beyond the MGJ. The bone or soft tissue loss in the interdental area and/or mispositioning of teeth is so severe that root coverage cannot be anticipated.



✓ **There are limitations that need to be considered:**

1. The reference point for classification is MGJ. The difficulty in identifying the MGJ creates difficulties in the classification between Class I and II. There is no mention of presence of keratinized tissue.

2. In Miller's Class III and IV recession, 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 amount of loss. A clear picture of severity of recession is hard to project.

3. Class III and IV categories of Miller's classification stated that marginal tissue 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 that 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 Classes 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 case of a missing adjacent tooth, there is no reference point and it is impossible to include this case in the Class III or Class IV.

5. Miller's classification does not specify facial (F) or lingual (L) involvement of the marginal tissue.

6. Recession of interdental papilla alone cannot be classified according to the Miller's classification. It requires the use of an additional classification system.

7. Classification of recession on palatal aspect is another area of 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 palatal aspect.

8. Miller's classification estimates the prognosis of root coverage following grafting procedure. Miller stated that 100% coverage can be anticipated in Class I and II recessions, partial root coverage in Class III and no root coverage in Class IV.

Cairo classification of gingival recession **Cairo *et al*. (2011)** :

Classified gingival recession based on the assessment of CAL at both buccal and interproximal sites.

Recession Type	The criteria
Type 1 (RT1)	Gingival recession with no loss of interproximal attachment. Interproximal CEJ was clinically not detectable at both mesial and distal aspects of the tooth
Type 2 (RT2)	Gingival recession associated with loss of interproximal attachment. The amount of interproximal attachment loss (measured from the interproximal CEJ to the depth of the interproximal pocket) was less than or equal to the buccal attachment loss (measured from the buccal CEJ to the depth of the buccal pocket)
Type 3 (RT3)	Gingival recession associated with loss of interproximal attachment. The amount of interproximal attachment loss (measured from the interproximal CEJ to the depth of the pocket) was higher than the buccal attachment loss (measured from the buccal CEJ to the depth of the buccal pocket).

This classification provides a simplified method of categorizing gingival recession and also emphasizes the role of interproximal attachment level, one of the important site-related prognostic factor. However, it does not consider the remaining width of attached gingiva, relationship of 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.

- **Furcation Involvement index: (Glickman,1953)**

A furcation is defined as ‘‘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. One of the first proposed classifications was the one by **(Glickman,1953)**

This classification system probably is the most widely used and it describes the main characteristics of furcation lesions:

Grade I involvement: it is the incipient or early lesion. The pocket is supra-bony, involving the soft tissue; there is slight bone loss in the furcation area. Radiographic change is not usual, as bone changes are minimal.

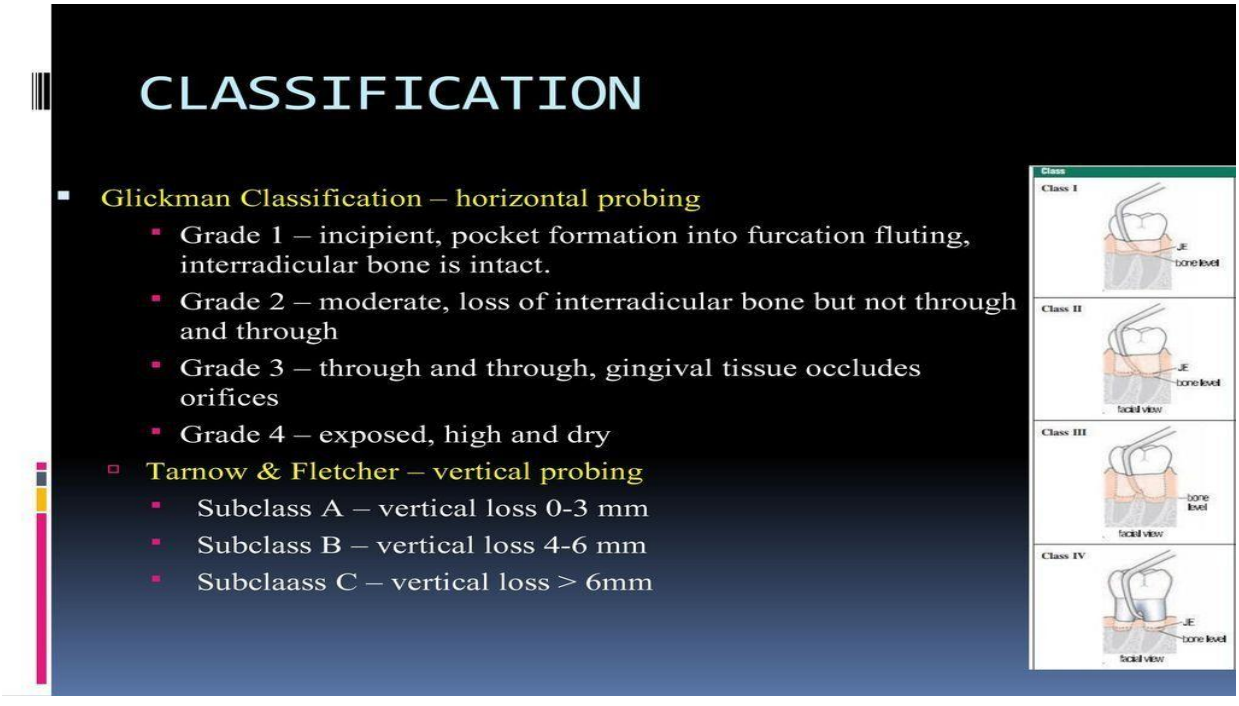
Grade II involvement: the bone is destroyed on one or more aspects of the furcation, but a portion of the alveolar bone and periodontal ligament remain intact, thus allowing only partial penetration of the probe into the furcation area. The radiograph may or may not reveal the grade II furcation involvement.

Grade III involvement: the inter-radicular bone is completely absent, but the facial and/or lingual orifices of the furcation are occluded by gingival tissue. Therefore, the furcation opening cannot be seen clinically, but it is essentially a through and through tunnel. If the radiograph of the mandibular molars is taken with a proper angle and the roots are divergent,

these lesions will appear on the radiograph as a radiolucent area between the roots. The maxillary molars present a diagnostic difficulty owing to roots overlapping each other.

Grade IV involvement: the inter-radicular bone underneath the roof of furcation is completely destroyed. The gingival tissue is also receded apically so that the furcation opening is clinically visible. The radiographic image is essentially the same as in grade III lesions.

Grade No.	Grade criteria
Grade I	Pocket formation into the flute, but intact interradicular bone (incipient)
Grade II	Loss of interradicular bone and pocket formation, but not extending through to the opposite side
Grade III	Through-and-through lesion, but gingival tissues occlude the orifices
Grade IV	Through-and-through lesion with gingival recession, leading to a clearly visible furcation area



Basic Periodontal Examination (BPE) Index:

♦ Developed by **British Society of Periodontology in 1986**.

♦ Derived from the Community Periodontal Index of Treatment Needs (CPITN).

♦ Simple and rapid screening tool that is used to indicate the level of examination needed and to provide basic guidance on treatment need.

♦ Not a diagnostic tool.

Score	Scoring criteria
0	No pockets > 3-5mm, no calculus overhangs, no bleeding after probing (black band completely visible
1	No pockets > 3-5mm, no calculus overhangs, but bleeding after probing (black band completely visible
2	No pockets > 3-5mm, but supra- or subgingival calculus overhangs (black band completely visible
3	Probing depth 3.5-5.5mm (black band partially visible, indicating pocket of 4-5mm)
4	Probing depth > 5.5mm (black band entirely within the pocket, indicating pocket of 6mm or more)
*	Furcation involvement

✓ Method of examination:

- The dentition is divided into 6 sextants {(upper right 13-23)(upper anterior13-23)(upper left24-27)(lower right 44-47)(lower anterion33-43)(lower left34-37)}.
- All teeth in each sextant are examined (with the exception of 3rd molars).
- For a sextant to qualify for recording, it must contain at least 2 teeth (if only one tooth is present in a sextant, the score for that tooth is included in the recording for the adjacent sextant)
- The recording is done by using WHO-periodontal probe.



