Measurements of Periodontal Diseases

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Lecture Objectives

- To determine an ideal outcome measure in periodontitis.
- To list outcome measures in periodontitis.
- To describe inherent measurement problems of each outcome measure.
- To determine the minimum requirements of a case definition for periodontitis.
- To describe markers of active periodontal disease and identify any measurement problems associated with them.
- To describe key gingivitis, periodontitis, and periodontitis treatment needs indexes.

An Ideal Outcome Measure

- Is the measure that most closely reflects the eventual negative outcome of tooth loss from periodontal disease.
- A measure that can be assessed objectively with the least measurement error [valid and reliable].
- A measure that reflects current disease activity.
- A quantitative measure sensitive to the severity of periodontal disease.
Outcome Measures in Periodontitis

1. Measures of Past Disease
   1. Tooth loss
   2. Alveolar bone loss
   3. Clinical attachment loss
   4. Periodontal probing depth
   5. Gingival recession

2. Measures of Current Activity
   1. Level of inflammatory cytokines in GCF

Tooth Loss

- Tooth loss is the most accurate measure of the influence of a risk factor in the progression of periodontal disease.
- Problems associated with this measure include:
  - No. of subjects needed
  - Time involved
  - Actual reason for tooth loss

Alveolar Bone Loss (ABL)

- Is strongly associated with tooth loss from periodontal disease.
- Radiographs needed, Not feasible in field studies.
- Is a quantitative measure.
- Can be calculated as a % of alveolar bone loss.
- May be reclassified into categories of periodontal destruction (mild, mod, severe), or dichotomized into "significant ABL" and "not significant ABL".
- Subject to measurement error.
### Clinical Attachment Loss

- Is strongly associated with tooth loss from periodontal disease.
- A diagnostic "gold standard" for periodontitis.
- Assessed clinically using a periodontal probe.
- Is a quantitative measure.
- May be classified into categories of periodontal destruction, or dichotomized into teeth with "significant CAL" and teeth with "no significant CAL".
- Subject to measurement error.

### Pocket Depth & Gingival Recession

- Both are component measures of CAL.
- Both are quantitative measures.
- The severity of bone destruction from periodontitis is generally, but not always, correlated to the severity of GR and/or PD.
- Both are subject to measurement errors.

### Gingivitis/Periodontitis Indices

- Various indexes have been used in the past.
- Many were composite indexes that scored gingivitis and periodontitis on the same scale.
- Therefore, composite indexes are now considered invalid and have been discarded.
- The GI is used to measure gingivitis; the PI and ESI are used to measure periodontitis; and the CPITN is used to measure periodontal treatment needs.
GI of Löe & Silness (1963)

- The most common index used to evaluate gingival status.
- Used to grade gingivitis Only to distinguish between healthy, mild, moderate, and severe disease.
- Used to evaluate the need for periodontal therapy and the effectiveness of different therapeutic regimens in clinical trials.

GI of Löe & Silness

- 0=Normal gingiva
- 1=Mild inflammations – slight change in color, slight edema. No bleeding on probing.
- 2=Moderate inflammation – redness, edema, and glazing. Bleeding on probing.
- 3=Severe inflammation – marked redness and edema. Ulceration. Spontaneous bleeding.

GI of Löe & Silness

- Each tooth is divided into 4 surfaces: DF papilla, F margin, MF papilla, and L margin
- Either all teeth or six selected teeth 6|1 4 and 4|1|5 may be used (Ramfjord teeth).
- GI of tooth= Total score of 4 surfaces/4
- GI score per person= Total score of examined teeth/Total No. of teeth examined
Advantages & Disadvantages

GI Advantages:
1. Measures gingivitis only w/o CAL.
2. Sufficiently sensitive to distinguish between little (0) and severe gingivitis (3).
3. BOP is a sensitive measure of gingivitis.

GI Disadvantages:
1. Not sensitive enough to distinguish between the middle ranges (1-2).
2. BOP is influenced by the force of probing (varies between 3-130 gm).

Modified Gingival Index (MGI)

The GI was modified using a non-invasive ordinal scoring system by Gordon et al. in 1985.

- 0=Normal (absence of inflammation)
- 1=Mild inflammation (slight change in color, little change in texture of any portion of the gingival unit)
- 2=Mild inflammation of the entire gingival unit.
- 3=Moderate inflammation (moderate glazing, redness, edema and/or hypertrophy) of the gingival unit.
- 4=Severe inflammation (marked by redness and edema/hypertrophy, spontaneous bleeding or ulceration) of the gingival unit.

Advantages of MGI

- Non-invasive technique
  - Elimination of soft tissue invasion and disrupting of plaque in the gingival region.
  - The degree of sensitivity as measured by bleeding on probing is rarely required in surveys or screening programs.
  - Concerns about infection control in field studies.
- MGI scale is expanded to 4 giving a greater sensitivity in detecting therapeutic efficacy.
- High correlation with the Löe-Silness index.
Papillary Bleeding Score (PBS)

- The PBS was introduced by Loesche in 1979.
- Bleeding is evaluated on a scale from 1-5 following the insertion of a Stimudent interdental cleaner interproximally:
  - 1=No bleeding
  - 2=Slight bleeding
  - 3=Bleeding with flow
  - 4=Intermediate bleeding (copious)
  - 5=Severe inflammation (spontaneous bleeding)
- The PBS was found to be the most reliable index (both intra- and inter-examiner) for measuring the gingival health status.

Russell Periodontal Index (1956)

- A composite index
- Does not measure CAL
- Grades all pockets ≥3 mm equally.
- Russell PI is Not valid anymore
Extent & Severity Index (ESI)

- ESI is a summary measure NOT a true index.
- "Extent" refers to number of teeth with CAL ≥1 mm and "severity" is the mean CAL of those teeth.
- Cutoff limit increased to 2 mm for reasons of examiner reliability.

Community Periodontal Index of Treatment Needs

- A modification of PTNS by the WHO (1982).
- A measure of treatment needs (Not a measure of periodontitis).
- Uses a modified periodontal probe (WHO probe).
- Data are presented in categorical forms (0-4) rather than mean values, and individuals are placed into treatment groups (1-4) based on the most severe oral finding.
- Modified into PSR (US), BPE (UK), and into CPI by the WHO (1994) to eliminate treatment need codes.
- CPI is considered the global standard for data on health planning.

CPITN Criteria

Examination Codes:
- Code 4: Pocket > 6 mm (black band of probe is not visible)
- Code 3: Pocket 4 or 5 mm (black band partially visible)
- Code 2: Supra- or subgingival calculus, restoration overhangs (entire black band visible)
- Code 1: Bleeding observed directly or upon gentle probing
- Code 0: Healthy gingiva

Treatment Needs:
- Code 4 >> Complex treatment: either deep scaling, curettage or surgical intervention.
- Code 3 >> Thorough scaling and OHI.
- Code 2 >> same as code 3.
- Code 1 >> OHI.
Advantages & Disadvantages

**Advantages include:**
1. Easy and quick method to assess treatment needs.
2. Increases knowledge and understanding of prevalence and distribution of periodontal disease.
3. Helps in planning of preventive periodontal services on a population level as well as for individuals.

**Disadvantages include:**
1. May over- or underestimate treatment needs among populations.
2. The treatment recommended is no longer valid.

Markers of Active Disease

- Inflammatory cytokines in GCF: PGE$_2$, TNF-α, IL-1α, and IL-β, and others.
- Quantifying inflammatory cytokines to reflect severity of periodontal disease is difficult.
- AST in GCF found associated with periodontitis.
- To date, these approaches to measure periodontitis are still being tested.

Case Definition of Periodontitis

1. To date, CAL is the diagnostic “gold standard” for periodontitis.
2. Any prevalence or incidence data must be interpreted in light of the population studied and the periodontitis case definition.
3. A case definition for periodontitis needs to establish:
   1. What depth of CAL at any one site constitutes evidence of disease processes (severity);
   2. How many such sites need to be present in a mouth to establish disease presence (extent); and,
   3. How to include probing measurements and BOP in the case definition.