EPIDEMIOLOGY of Periodontal Disease

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OBJECTIVE

• Define Terminology in Epidemiology.
• Describe indices used for assessment plaque, gingivitis and periodontitis
• Discuss the epidemiology of plaque-induced periodontal disease: gingivitis, periodontitis, natural history, aggressive periodontitis, gingival recession
• Discuss the distribution of periodontal disease in different areas of the mouth
• Describe the risk factors associated with chronic periodontitis
• Discuss the pattern progression of periodontitis: Burst Theory
Specialties

There are nine dental specialties recognized and require 2-6 years of further formal university training after dental school. The specialties are

1. **Dental Public Health** (study of dental epidemiology and social health policies),
2. **Endodontics** (*root canal* therapy),
3. **Oral and Maxillofacial Pathology** (study, diagnosis, and often the treatment of oral and maxillofacial related diseases),
4. **Oral and Maxillofacial Radiology** (study and radiologic interpretation of oral and maxillofacial diseases),
5. **Oral and Maxillofacial Surgery** (*extractions* and facial surgery),
6. **Orthodontics and Dentofacial Orthopaedics** (straightening of teeth),
7. **Pedodontics** (pediatric dentistry; i.e. dentistry for children),
8. **Periodontics** (treatment of gum disease),
9. **Prosthodontics** (replacement of missing facial anatomy by protheses such as dentures, bridges and implants).
Periodontology terms

- **Periodontics**: The branch of dentistry that specializes in treating the supporting tissues of the teeth and in the placement, maintenance and treatment of dental implants

- **Periodontology** is the branch of dentistry concerned with the health of the tooth supporting structures, ie. the gingiva, periodontal ligament, root cementum and alveolar bone. It also involves the placing of dental implants to replace missing teeth.
  - The word comes from the Latin word peri meaning around and the Greek word odous meaning tooth. Literally taken, it means study of that which is "around the tooth"

- **Periodontium**: The tissues that surround and support the teeth, including the gums, periodontal ligament and bone

- **Periodontist**: A dentist who has additional training in periodontics and specializes in the prevention, diagnosis and treatment of tissues surrounding the teeth and in the placement and maintenance of dental implants

(AAP)
What makes periodontics so special

• To learn how to prevent gum and periodontal disease
• To motivate oral hygiene care (more individual)
• To makes teeth life longer
• To treat gum and periodontal disease
• To achieve esthetic performance
• To promotes gum and bone healing and regeneration
Definitions Epidemiology of Periodontal Disease

- Epidemiology is the study of distribution of the disease within population. Epi (upon) + demos (people).
- To understand risk factors for periodontal disease and how they are related to the clinical observations that they make in their patients.
- The essential features of epidemiology as a method of research, when compared to clinical research and case studies, are that
  - Groups rather than individuals are the focus of study
  - Persons with and without a particular disease (e.g., periodontal diseases), and with and without the exposure of interest are included, rather than just patients.
• Incidence: Number of new cases that occur in a population over a given period of time.
• Prevalence: Number or percentage of affected persons in a population. For example, the prevalence of periodontal disease in populations may be characterized by assessing the percentage of persons with at least one site with clinical attachment loss $\geq 2$ mm, $\geq 4$ mm, or $\geq 7$ mm
Terminology used in Epidemiology

• Risk factor: A characteristic that is associated with a disease.
• The association may or may not be causal.
• This term is usually reserved for environmental, behavioral or biologic exposures or characteristics that have been related to the disease through longitudinal/cohort studies.
• If present, the factor directly increases the probability of disease occurrence, and if absent, reduces the probability.
Terminology used in Epidemiology

• Risk indicator: A probable or putative risk factor that has been associated with the disease through cross-sectional studies.

• Risk indicators identified in cross-sectional studies are not always confirmed as risk factors in longitudinal studies.
Terminology used in Epidemiology

- **Odds ratio**: Odds represent the ratio of the probability of occurrence of an event to that of nonoccurrence and *odds ratio* (OR) is the ratio of two odds. Consider the following situation.

- The odds ratio is equal to the odds of being exposed among the subjects with disease divided by the odds of being exposed among the healthy subjects.

\[
\begin{array}{c|cc}
\text{Exposed} & \text{Diseases} & \text{Healthy} \\
\hline
a & c \\
\hline
b & d \\
\end{array}
\]

\[
\text{OR} = \frac{a/b}{c/d} = \frac{ad}{cd}
\]
Terminology used in Epidemiology

• An odds ratio equal to 1.0 indicates lack of an association.
• >1.0 indicates that subjects were more likely to have been exposed than the healthy subjects
• <1.0 indicates that the level of exposure was greater for the healthy group
Periodontal Epidemiology

Specific problems arise in periodontology:

- **Inflammatory periodontal diseases are very high prevalence**
- Progression of the disease is still not fully understood:
  - Lesions usually develop very slowly.
  - There is some evidence that progression is discontinuous.
- Loss of tooth-supporting apparatus is essentially irreversible.
- Complex, multifactorial etiology.
- In epidemiological studies on periodontal health, three different parameters have to be assessed:
  - **Prevalence** of the disease, i.e., the proportion of diseased individuals
  - **Extent** of the disease, i.e., the number or proportion of affected subunits (teeth, tooth surfaces)
  - **Severity** of the disease: amount of attachment loss, depth of periodontal pockets
Periodontal Epidemiology

• These fundamentals were not observed in investigations conducted before about 1975.
  – Data from older studies cannot be compared with data from more recent surveys.
  – In older studies, tooth loss in particular was erroneously considered to be definitive evidence of severe periodontal disease.

• Recent evidence from the 1980s and 1990s has profoundly modified our understanding of the natural history of periodontitis:
  – Gingivitis does not lead inevitably to periodontitis.
  – Aggressive forms of periodontitis, which result in premature tooth loss, are quite rare.
  – Mild or moderate forms are widespread. Almost every adult shows some loss of attachment without experiencing any functional problems.
  – Even after age of 35 years, periodontitis is not the main cause of tooth loss.
Examination Methods

• The extent and the severity of periodontal diseases and etiological factors such as plaque and dental calculus are often assessed as qualitative (ordinal) variables by means of index systems.
Indices for assessment of gingivitis

- *Gingival Index* (GI, Loe and Silness 1963), mainly used in scientific studies
- *Sulcus Bleeding Index* (SBI, Mühlemann and Son 1971)
- *Papilla Bleeding Index* (FBI, Saxer and Mühlemann 1975)
- *Gingival Bleeding Index* (Ainamo and Bay 1975)

In some index systems, the sulcus is cautiously probed and the proportion of bleeding gingival units calculated
### Criteria for the Gingival Index

<table>
<thead>
<tr>
<th>Score</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal gingiva</td>
</tr>
<tr>
<td>1</td>
<td><strong>Mild inflammation</strong>: slight change in color, slight edema, no bleeding on probing</td>
</tr>
<tr>
<td>2</td>
<td><strong>Moderate inflammation</strong>: redness, edema and glazing, bleeding on probing</td>
</tr>
<tr>
<td>3</td>
<td><strong>Severe inflammation</strong>: marked redness and edema, ulcerations; tendency toward spontaneous bleeding</td>
</tr>
</tbody>
</table>

Gingival Bleeding Index (Ainamo and Bay 1975)

BOP = bleeding on probing
- no bleeding upon probing (not recorded)
+ bleeding upon probing

Calculation

\[
\text{BOP} = \frac{\text{Number of bleeding sites}}{\text{Number of sites evaluated}} \times 100
\]

Example: \[\frac{71}{124} \times 100 = 57\%\]
Papilla Bleeding Index (FBI, Saxer and Mühlemann 1975)

131 Grade 1—Point
20–30 seconds after probing the mesial and distal sulci with a periodontal probe, a single bleeding point is observed.

132 Grade 2—Line/Points
A fine line of blood or several bleeding points become visible at the gingival margin.

133 Grade 3—Triangle
The interdental triangle becomes more or less filled with blood.

134 Grade 4—Drops
Profuse bleeding. Immediately after probing, blood flows into the interdental area to cover portions of the tooth and/or gingiva.
Papilla bleeding index-PBI (Saxer and Mühlemann, 1975)
Bacterial Deposits

Index systems for plaque and dental calculus:

• **Oral Hygiene Index** (OHI or OHI-S; Greene and Vermillion 1960,1964). May be subdivided into:
  – ODI: debris index (soft deposits);
  – OCI: calculus index;

• **OHI-S** (simplified): considers labial surfaces of FDI teeth nos. 16, 11, 26, and 31, as well as lingual surfaces of teeth 36 and 46.

• Grading: deposits cover up to one-third of the tooth surface (grade 1), more than one-third (grade 2), or more than two-thirds (grade 3).
Bacterial Deposits

- **Quigley-Hein Index (OHI):** assessment of plaque on the labial surfaces of the anterior teeth, with grading from 0 to 5 (Quigley and Hein 1962).
- Turesky *modification of OHI:* assessment of facial and lingual surfaces of all teeth (Turesky et al. 1970).
- Plaque Index (PII; Silness and Loe 1964): assessment of marginal plaque

Simple systems take account only of the presence or absence of visible plaque and calculate the percentage of positive surfaces:

- **Plaque Control Record (PCR; O'Leary et al. 1972),** assesses four sites on each tooth present.
Oral Hygiene Index (OHI, Greene and Vermillion 1960)

- 2 separate components:
  - Debris Index (DI)
  - Calculus Index (CI)
- The OHI score is the sum of DI and CI scores
- With this index, disease levels are now related to levels of OH
Oral Hygiene Index (OHI, Greene and Vermillion 1960)

Debris Index, DI
- coronal extension of plaque
- score

0 no debris or stains
1 debris < 1/3 rd tooth surface
2 between 1/3rd and 2/3rd
3 debris > 2/3rd tooth surface

Calculus Index CI
- coronal extension of supragingival +/- extension of subgingival calculus
- Score

0 no calculus
1 supragin calc < 1/3 rd tooth surface
2 between 1/3rd and 2/3rd & specks of subgin calculus
3 supragin > 2/3rd tooth surface & continous band of subgin.calculus
### Quigley & Hein, Turesky Modification

<table>
<thead>
<tr>
<th>Score</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No plaque in gingival area.</td>
</tr>
<tr>
<td>1</td>
<td>Noncontinuous flecks of plaque at the cervical margin of the tooth.</td>
</tr>
<tr>
<td>2</td>
<td>Thin continuous band of plaque at the cervical margin of the tooth (up to 1 mm).</td>
</tr>
<tr>
<td>3</td>
<td>A continuous band of plaque wider than 1 mm but covering less than one third of the crown.</td>
</tr>
<tr>
<td>4</td>
<td>Plaque covering at least one third but less than two thirds of the crown of the tooth.</td>
</tr>
<tr>
<td>5</td>
<td>Plaque covering more than two thirds of the crown of the tooth.</td>
</tr>
</tbody>
</table>

Note: A disclosing solution should be used prior to the assessment.

Plaque index/Plaque Control Record (PCR, O’Leary et.al 1972)

For this test, the plaque is disclosed, with disclosing tablet.
### Criteria for the Plaque Index (PII)

<table>
<thead>
<tr>
<th>Score</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No plaque in gingival area.</td>
</tr>
<tr>
<td>1</td>
<td>No plaque visible by the unaided eye, but plaque is made visible on the point of the probe after it has been moved across surface at entrance of gingival crevice.</td>
</tr>
<tr>
<td>2</td>
<td>Gingival area is covered with a thin to moderately thick layer of plaque; deposit is visible to the naked eye.</td>
</tr>
<tr>
<td>3</td>
<td>Heavy accumulation of soft matter, the thickness of which fills out niche produced by gingival margin and tooth surface: interdental area is stuffed with soft debris.</td>
</tr>
</tbody>
</table>

**Note:** There is no need for the use of disclosing solution before the assessment.

Combined Indices

Systems combining the assessment of gingivitis, periodontitis, or even plaque, calculus, overhanging restoration

• *Periodontal Index* (PI; Russel 1967); no special instruments are necessary:
  – 1 or 2: localized or circumferential gingivitis, respectively
  – 6: initial periodontitis without impairment of function
  – 8: advanced periodontitis with functional impairment
Combined Indices

• *Periodontal Disease Index* (PDI; Ramfjord 1959):
  – 1-3: severity of gingivitis
  – 4-6: attachment losses of up to 3mm, 4-6 mm, and 7 mm or more.

• Community *Periodontal Index* (CPI; Ainamo et al. 1982, World Health Organization 1997):
  – Assessment of the highest *score in each* sextant
  – May also be used for individual periodontal screening and recording (PSR) or Basic Periodontal Examination (BPE).
# Box 3-4 Criteria for the Periodontal Index

<table>
<thead>
<tr>
<th>Score</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td><em>Normal gingiva:</em> There is neither overt inflammation in the investing tissues nor loss of function because of destruction of supporting tissues.</td>
</tr>
<tr>
<td>1</td>
<td><em>Mild gingivitis:</em> There is an overt area of inflammation in the free gingiva, but this area does not circumscribe the tooth.</td>
</tr>
<tr>
<td>2</td>
<td><em>Gingivitis:</em> Inflammation completely circumscribes the tooth, but there is no apparent break in the epithelial attachment.</td>
</tr>
<tr>
<td>6</td>
<td><em>Gingivitis with pocket formation:</em> The epithelial attachment has been broken and there is a pocket (not merely a deepened gingival crevice caused by swelling in the free gingiva). There is no interference with normal masticatory function.</td>
</tr>
<tr>
<td>8</td>
<td><em>Advanced destruction with loss of masticatory function:</em> The tooth may be loose, may have drifted, may sound dull on percussion with a metallic instrument, or may be depressible in its socket.</td>
</tr>
</tbody>
</table>

Community Periodontal Index of Treatment Needs (CPITN)

<table>
<thead>
<tr>
<th>Score</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal gingiva</td>
</tr>
<tr>
<td>1</td>
<td>Bleeding after probing. No calculus and the periodontal pockets are less than 4 mm.</td>
</tr>
<tr>
<td>2</td>
<td>Calculus felt during probing but pockets are less than 4 mm.</td>
</tr>
<tr>
<td>3</td>
<td>Pocket 4 or 5 mm.</td>
</tr>
<tr>
<td>4</td>
<td>Pocket $\geq$ 6 mm.</td>
</tr>
</tbody>
</table>

The following index teeth are examined and a single score is given for each tooth:

<table>
<thead>
<tr>
<th>Persons $\leq$ 20 years-old</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>8</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>24</td>
<td>19</td>
<td></td>
</tr>
</tbody>
</table>

| Persons 20 years or older |  |  |  |  |  |
|----------------------------|---|---|---|---|
| 2                          | 3 | 8 | 14| 15|
| 31                         | 30| 24| 19| 18|

Among young people the second molars are not examined to avoid classifying the deepened crevices associated with eruption as periodontal pockets. For the same reason, the World Health Organization does not recommend the recording of pockets for children younger than 15 (i.e., only bleeding and calculus should be considered).
Attachment Loss

The amount of supporting tissue which has actually been lost can be measured:

- Clinical attachment loss:
  - Vertical distance between the clinically probed bottom of the pocket or sulcus and the cej.
  - If the cej is located subgingivally, the periodontal probing depth is determined first, then the cej is identified with the probe and the distance to the gingival margin subtracted from the probing depth.
  - Horizontal attachment loss is usually related to furcation involvement.
Teeth
- Condition of the hard structures
- Plaque accumulation
- Restorations (oral hygiene)

Gingiva
- Erythema
- Swelling
- Ulceration
- Recession

Oral Mucosa
- Fluorescences
- Discolorations
- Precancerous areas
- Tumors
**Box 3-8  Most Frequently Used Partial Mouth Examination Protocols**

<table>
<thead>
<tr>
<th>Subset</th>
<th>Examined Teeth</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Half-mouth</td>
<td>All teeth in one upper and one lower, randomly selected, quadrants.</td>
<td>Examination of these subsets produces accurate estimates of <strong>extent</strong> and <strong>severity</strong> of periodontal disease and gingivitis (e.g., extent: % sites with CAL &gt; 2 mm, % sites bleeding after probing, etc.; Severity: mean attachment levels, mean probing depths, mean gingival index scores, etc.). However, examination of these tooth subsets results in gross underestimation of the true <strong>prevalence</strong> of periodontal conditions.</td>
</tr>
<tr>
<td>Ramfjord teeth</td>
<td>3 9 12</td>
<td></td>
</tr>
<tr>
<td>CPITN-2</td>
<td>2 3 8 14 15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>31 30 24 19 18</td>
<td></td>
</tr>
</tbody>
</table>
Epidemiology of Plaque-Induced Periodontal Diseases

• Inflammatory periodontal diseases associated with dental plaque are among the most frequent diseases of man.

• Inflammatory alterations of the gingiva are found in most children even in the primary dentition.

• The prevalence and extent of gingivitis reach their maximum at the onset of puberty, at about 11 years in girls, in boys about 2 years later.
Fig. 4.2 Extent of gingivitis (PMA index: papilla, marginal gingiva, attached gingiva) in children (Massler et al. 1952). A maximum is reached at the onset of puberty, in girls at age 11, in boys at age 13.
Epidemiology of Gingivitis

- Morbidity and severity figures differs (8-89%)
- Varying levels of oral hygiene, geographic, social and ethnologic factors
- In the young, reversible gingivitis is most common
- Gingivitis to some extent, is reversible even without professional treatment.
• Morbidity of gingivitis in 10,000 persons. A peak is observed during puberty (Stamm, 1986)
• Gingivitis occurs in 26% of 5-year-olds, 62% of 9-year-olds and 52% of 15-year-olds (Children's Dental Health Survey, UK, 1993).

• In 1993 approximately 10-15% more children aged 6-12 years had gingivitis compared with 1983.
• Morbidity of gingivitis in 10,000 persons. A peak is observed during puberty (Stamm, 1986)
Epidemiology of Periodontitis

The prevalence of periodontitis had been studied all over the world since the 1950s.

• Examination criteria have differed considerably.
• In most studies, only prevalence of the disease was determined:
  – Gingivitis seems to diminish continuously after the age of 15 years. Concomitantly, periodontitis increases dramatically, reaching 100 % after the age of 35 years.
  – Tooth loss gradually affects more and more individuals
Fig. 4.3 Prevalence of gingivitis, periodontitis, and tooth loss (Marshall-Day et al. 1955). In adolescents, a very high prevalence of gingivitis was noted, which subsequently rapidly declined. Simultaneously, however, the prevalence of periodontitis increased steeply, reaching almost 100% after the age of 35 years. The proportion of individuals with tooth loss increased linearly from the age of about 20 years onwards.
Natural history of periodontitis

• was studied in a longitudinal investigation of Sri Lankan tea workers who had received no dental care:
• 8% of the population developed a rather aggressive form of the disease:
  – Average attachment loss was more than 1 mm per year.
• 81% of the population developed a mild, chronic, form of periodontitis:
  – Annual attachment loss increased from an average of 0.3 mm by the age of 30 to 0.5 mm at the age of about 45.
• In 11% of the population no relevant attachment loss was observed.

Note: This and other investigations have shown that about 7-15% of a given population suffer from a severe form of periodontitis.
Figure 3-2. Mean clinical attachment loss (CAL)* by age for Sri Lankans with slow, moderate, and rapid periodontal disease progression (n = 480). Solid lines represent trends in mean CAL generated by second- and third-degree polynomial functions. (From Löe H, Anerud A, Boysen H: Natural history of periodontal disease in man. Rapid, moderate and no loss of attachment in Sri Lankan laborers 14 to 46 years of age, J Clin Periodontol 13:431, 1986.)
Attachment loss and probing depth

- The largest population-based study carried out in the USA (1988 and 1994):
  - Attachment losses of 3 mm or more were found in 53% of 30 to 90-year-olds.
  - Probing depths of 3 mm or more were observed in about 64% of individuals.
Furcation involvement

- About 14% of individuals aged 30 years and older had at least one tooth with furcation involvement.
- A single furcation involvement was observed in 10%, while 4% had 2 or more teeth affected.

Figure 21-29. Clinically visible furcation on a mandibular first molar.
Aggressive Periodontitis

• The largest population-based study of 14- to 17-years-olds was conducted by the National Institute of Dental and Craniofacial Research (NIDCR) in 1986-1987 in the USA.
• About 0.5% of individuals had localized aggressive periodontitis: 0.1% among whites and 2% among African Americans.
• 0.1% had generalized aggressive periodontitis: 0.03% of whites and 0.6% of African Americans.
• Worldwide, the prevalence of aggressive periodontitis seems to vary considerably.
• *Note:* the disease is apparently more prevalent in black populations:
  • 0.1-0.2% in Europe
  • More than 6% in Uganda
  • 0.8% in Nigeria
  • 3.7% in Brazil
<table>
<thead>
<tr>
<th>Population</th>
<th>Prevalence</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. African Americans</td>
<td>2.1-2.6%</td>
<td>82, 83</td>
</tr>
<tr>
<td>U.S. whites</td>
<td>0.09-0.17%</td>
<td>82, 83</td>
</tr>
<tr>
<td>Swiss</td>
<td>0.1%</td>
<td>84</td>
</tr>
<tr>
<td>Dutch</td>
<td>0.1-0.2%</td>
<td>85</td>
</tr>
<tr>
<td>Norwegian</td>
<td>0.2%</td>
<td>86, 87</td>
</tr>
<tr>
<td>Finnish</td>
<td>0.1%</td>
<td>88</td>
</tr>
<tr>
<td>Danish</td>
<td>0.1%</td>
<td>89</td>
</tr>
<tr>
<td>Chileans</td>
<td>0.32%</td>
<td>90</td>
</tr>
<tr>
<td>Brazilians</td>
<td>0.32-3.7%</td>
<td>91, 92</td>
</tr>
<tr>
<td>Saudis</td>
<td>0.42%</td>
<td>93</td>
</tr>
<tr>
<td>Japanese</td>
<td>0.47%</td>
<td>94</td>
</tr>
<tr>
<td>Italians</td>
<td>0.51%</td>
<td>95</td>
</tr>
<tr>
<td>Nigerians</td>
<td>0.75-0.8%</td>
<td>96</td>
</tr>
<tr>
<td>Afro-Caribbean</td>
<td>0.80%</td>
<td>97</td>
</tr>
<tr>
<td>Ugandans (blacks)</td>
<td>6.5%</td>
<td>98</td>
</tr>
</tbody>
</table>
Prevalence, Extent, and Severity of **Gingival Recession**

Gingival recession apparently occurs in two different forms:

1. Induced by injury, especially due to inappropriate tooth brushing. In this form, the gingiva is virtually free of inflammation:
   - Most often, buccal surfaces of canines and premolars are affected.
   - Less often, lingual or palatal surfaces—usually the first maxillary molars—are affected.

2. The other form is due to longstanding chronic *inflammation* in the course of periodontitis. In survey (USA), the following observations were made:
   - 58% of those more than 30 years old had at least one site with $\geq 1$ mm recession.
   - Recession of at least 3 mm was found in 22% of individuals.
   - On average, 22% of teeth were found to have a recession of at least 1 mm.
Fig. 4.8 There are two different forms of gingival recession.

a Age-dependent increase of the proportion of tooth surfaces with recession in a Norwegian population with excellent dental service and a high level of oral hygiene. Buccal and, to a lesser extent, lingual surfaces are those most affected.

b Age-dependent increase in the proportion of tooth surfaces with recession in workers in a tea plantation in Sri Lanka with no dental service and no special oral hygiene measures. In these individuals, recession extent increases also on proximal surfaces. (Adapted from Löe et al. 1992)
The rate of plaque and gingivitis formation observed by Loe et.al (1965)

• The strong association previously described between plaque and calculus and periodontal disease
• Their classic study of experimental gingivitis. It can be seen that when brushing is omitted from oral hygiene cleansing procedures, the formation of plaque and the development of gingivitis are closely parallel.
• In the study both increased with time, reaching a maximum at 15 to 21 days, when all subjects experienced a maximum of gingivitis.
• Reinstition of tooth brushing demonstrated
  – the reversible nature of gingival inflammation,
  – decrease in plaque and gingivitis formation.
Distribution Of Periodontal Disease In Different Areas Of The Mouth

Table 5–12. SEVERITY OF GINGIVITIS FOR THREE DIFFERENT AREAS BY ARCH*

<table>
<thead>
<tr>
<th>Area</th>
<th>Arch</th>
<th>Mean Gingival Index Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interproximal</td>
<td>Upper &gt; lower</td>
<td>1.44 &gt; 1.20</td>
</tr>
<tr>
<td>Buccal</td>
<td>Upper &gt; lower</td>
<td>1.23 &gt; 1.13</td>
</tr>
<tr>
<td>Lingual</td>
<td>Lower &gt; upper</td>
<td>0.89 &gt; 0.46</td>
</tr>
</tbody>
</table>

FIGURE 5–7. Intraoral distribution of gingivitis severity by tooth surface and area of mouth. Data are for 400 males 15 to 34 years of age. The Dental Health Center Index (DHCI) was used to assess gingivitis by marginal and papillary units for all teeth. Tooth numbers are defined as follows: 1, central incisor; 2, lateral incisor; 3, canine; 4, first premolar; 5, second premolar; 6, first molar; 7, second molar. (Adapted from Suomi JD, Barbano JP. Patterns of gingivitis. J Periodontol 39:71, 1968.)
FIGURE 5–8. Intraoral prevalence of calculus by individual teeth. The percentage of supragingival and subgingival calculus is presented by tooth and arch. Tooth numbers are as defined in Figure 5–7; 8, third molar. (Adapted from Schroeder HE. Formation and Inhibition of Dental Calculus. Vienna, H. Huber Publishers, 1969.)
FIGURE 5–9. Intraoral prevalence of periodontal disease by individual teeth. The percentages of teeth affected by periodontal disease are classified as most, moderate, and least. Data are for industrial workers 40 to 44 years of age, with men and women combined. Tooth numbers are defined in Figures 5–7 and 5–8. (Adapted from Bosser WA, Marks HH: J Am Dent Assoc 52:429, 1956 by permission of ADA Publishing Co., Inc.)
Distribution gingival recession and probing depth

- Over 70% of the sample had one or more teeth with ≥1 mm of gingival recession
- The extent of gingival recession was greatest for midbuccal sites on mandibular premolars followed by midbuccal sites on maxillary premolars and mandibular molars.
- In the mandible, more distolingual sites had probing depths of ≥4 mm, but a higher percentage of mesiobuccal sites was affected in the maxilla, and molars were the most affected, followed by premolars, incisors, and canines.
- Bleeding after probing was more extensive in the mandible than in the maxilla.

(Dr. W. Murray Thomson, Journal of Periodontology, 2000, Vol. 71, No. 12, Pages 1840-1845)
Factors Associated with Chronic Periodontitis
Age

• Positive association

• Risk indicator

• As age increases, the prevalence, extent and severity of chronic periodontitis also increase. However, the rate of progression or the likelihood of disease progression is not related to the age of an individual. Age is a poor predictor of future disease
Sex

- Males tend to have more periodontal disease than females
- *Risk indicator*
- This association has been observed in the United States and other populations from industrialized nations. However, this association is not consistently found in populations with limited access to dental care. This association is most likely related to behavioral differences between males and females
Socioeconomic status (SES), education, and access to dental care

• Negative association
• Risk indicator
• Groups of lower SES, less education, and limited access to dental care have more periodontal tissue destruction
Race-ethnicity

• In the United States the prevalence, extent, and severity of periodontal tissue destruction is greatest among African Americans, intermediate among Mexican Americans and lowest among white individuals.

• Risk indicator

• Such differences may be because of discrepancies in access to dental care and education
Tobacco use

- Positive association
- *Risk factor*
- Strongest modifiable risk factor and predictor of future disease and periodontal treatment outcomes
Diabetes

• Positive association
• Risk factor
• Patients with diabetes, especially those with poor glycemic control and type I (insulin-dependent) diabetes, tend to have more periodontal tissue destruction
HIV-infection

- Positive association
- *Possible risk factor*
- HIV-positive patients, especially those who are not receiving medical treatment, those with CD4+ counts <200 cells/µl and those who are severely immunocompromised, are at increased risk for periodontitis
Osteoporosis

- Positive association
- *Possible risk factor*
- Among females with high calculus scores, those with osteoporosis and osteopenia have more attachment loss than control subjects with normal bone density
Psychological stress

- *Possible risk factor*
- Weak association
Pattern progression of periodontitis: Burst Theory

• Despite presence of inflammation, most sites show NO progression.

• Loss of attachment (LOA) occurs rapidly at few sites, interspersed with long period of no activity.

• “Burst” might occur randomly throughout life, and can involve many sites.

• Implication:
  – Plaque and inflammation do not indicate further breakdown
  – Gingivitis may persist without progressing to periodontitis
Fig. 1.1 Hypothetical cross-sectional data of mean attachment loss in 14 subjects. The average rate of attachment loss (solid line) is approximately 2 mm every 10 years, but it is clear that there is considerable inter-subject variation. Subject C appears to be highly susceptible to periodontal breakdown. Subject N appears to be relatively resistant to breakdown.
Fig. 1.2 Hypothetical longitudinal data showing the attachment loss at four different sites (A, B, C, D) in one patient at an initial examination and after periods of two, four, six, and eight years.
Fig. 1.3 Gradual destruction model of periodontal breakdown. The graph shows periodontal attachment loss at four sites (A, B, C, D). In the absence of adequate treatment the pockets slowly progress with time, although at different rates from each other.
Fig. 1.4  Burst hypotheses of periodontal breakdown showing disease progression at four sites.

(a) Random burst model: periodontal disease progresses in short, randomly occurring bursts throughout adult life, interspersed with long periods of quiescence in between.

(b) Asynchronous multiple burst model: again, periodontal disease progresses in bursts, interspersed with periods of quiescence. However, most of the bursts are clustered during a short period of the patient’s life – in this case between the ages of 30 and 35 years. Thus ‘multiple bursts’ occur from age 30–35, but they are not simultaneous (i.e. they are ‘asynchronous’).
Summary

- Data on the prevalence of gingivitis and periodontitis are dependent on how the disease is defined and the age group from which they were taken.
- Data show that gingivitis is found in early childhood, is more prevalent and severe in adolescence, and then tends to level off in older age groups. Some 8% to 89% of any population suffers from gingivitis.
- Some 5% to 20% of any population suffers from severe, generalized periodontitis, although mild to moderate periodontitis affects a majority of adults. For those who are most susceptible, periodontitis becomes evident in teenage and early adult years rather than the later years.
- Risk factors for periodontitis include smoking, genetic predisposition, probably psychosocial stress, diabetes, and several uncommon systemic diseases.
GI (Loe and Silness, 1963)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal gingiva; no inflammation; no discoloration (erythema); no bleeding</td>
</tr>
<tr>
<td>1</td>
<td>Mild inflammation; slight erythema; minimal superficial alterations. <strong>No bleeding</strong></td>
</tr>
<tr>
<td>2</td>
<td>Moderate inflammation; erythema; <strong>bleeding on probing</strong></td>
</tr>
<tr>
<td>3</td>
<td>Severe inflammation; severe erythema and swelling; <strong>tendency to spontaneous bleeding</strong>; possible ulceration.</td>
</tr>
</tbody>
</table>
### Periodontal Disease Index (PDI; Ramfjord 1959):

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Inflammation-free. No gingival alterations</td>
</tr>
<tr>
<td>1</td>
<td>Mild to moderate gingivitis at isolated sites on the gingiva surrounding the tooth</td>
</tr>
<tr>
<td>2</td>
<td>Mild to moderate gingivitis surrounding the tooth</td>
</tr>
<tr>
<td>3</td>
<td>Severe gingivitis, visible erythema, hemorrhage, gingival ulcerations</td>
</tr>
<tr>
<td>4</td>
<td>Attachment loss to 3 mm, measured from the CEJ</td>
</tr>
<tr>
<td>5</td>
<td>3–6 mm attachment loss</td>
</tr>
<tr>
<td>6</td>
<td>Attachment loss greater than 6 mm</td>
</tr>
</tbody>
</table>
References

• Mueller HP: Periodontology: the essentials, 1st ed, Thieme, Germany, 2005, p.38-46
• Rose LF, Mealey BL: Periodontics, 1st ed, Elsevier Mosby, 2004, p.32-68