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Preface

Dentistry has transformed with advances in technology, new business models, and demographic and cultural shifts. However, the traditional focus on caries and periodontal disease management remains as important as ever. This requires current dental students to be nimble, proactive learners who can independently work on clinical cases, collaborate across disciplines, and propose intelligent solutions to treatment challenges. At the same time, dental students are more likely to practice outside of a specialty-based dental school clinic, so they may have limited access to specialists and other experts who can guide them through clinical challenges.

Often, these challenges are caused by common periodontal diseases, which complicate restorative dental treatment and cause premature tooth loss. However, periodontal disease diagnosis and treatment are rarely simple and not easily grasped by dental students. Since periodontal specialist faculty may not be readily available for guidance and traditional textbooks in periodontology are too unwieldy for easy reference, we intended to provide a concise guide to periodontal treatment.

The focus of this book is to provide a “how-to” approach to periodontal treatment for a 2nd or 3rd year dental student who has just started practicing dentistry and a dental student gaining experience in periodontal surgery as part of a surgical elective. This book may also serve as a quick introductory guide for a resident who has just started his/her postdoctoral specialist program prior to more in-depth learning.

In Chapter 1, we have provided a summary of the foundational scientific knowledge that underpins periodontal treatment. The rest of the book has been arranged in a logical sequence mirroring the manner in which patients with periodontal disease are treated. Chapters 2 to 4 depict how to assess a patient and provide thought processes for diagnosis, treatment planning, prognosis, and extraction decisions. Chapter 5 deals with nonsurgical treatment aimed at reducing periodontal inflammation, and in Chapters 6 to 9 surgical approaches to address residual deep pockets, furcations, mucogingival defects, and tooth mobility have been discussed.

Each chapter is preceded by a detailed clinical case and a case commentary that previews key aspects of the chapter. These can be used either as a pre-class assignment for

a flipped classroom approach or case-based learning in small groups moderated by a facilitator. This is followed by basic foundational knowledge or detailed “how-to” instructions to augment clinical teaching. For review purposes, we have summarized key clinical pearls at the end of each chapter along with detailed case-based NDBE-style questions and explanations of answer choices. We have also suggested research activities and recent literature that can be used to hone evidence-based dentistry skills. Key terminology is highlighted in **bold** where first introduced in the chapters.

In summary, we hope that this guide to periodontal treatment will be a simple, accessible reference source for dental students and residents facing their first clinical challenges. While we attempt to share the knowledge that we wished we had as dental students, we would also like to encourage students to continue to seek out knowledge from different instructors, mentors, and practitioners since “not all knowledge is found in one school.”¹

Safety Warnings:

- Medications and local anesthetics used in periodontal treatment can trigger severe allergic reactions or side effects in some patients.
- Do not perform periodontal surgery on patients with severe, uncontrolled medical conditions until the patient's medical condition has been adequately controlled. Consult with the patient's medical specialists if necessary to develop a pre and postoperative management plan that addresses the patient's medical needs.
- Do not perform periodontal surgery on a patient with a high risk of infective bacterial endocarditis or other severe infection risk without providing antibiotic prophylaxis.
- Consider the risk of osteonecrosis of the jaw in patients who received bisphosphonates or other treatments that affect bone, and carefully weigh benefits and risks of periodontal surgery.

*Tobias K. Boehm, DDS, PhD
Sam Chui, DDS, FAGD*

¹ “A’ohe pau ka ‘ike i ka hālau ho’okahi”, Hawaiian proverb, recorded and translated by K. Maly (2001)

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Tobias K. Boehm, DDS, PhD

1 Background: Periodontal Disease Mechanisms and Wound Healing

Abstract

Periodontal diseases are one of the most common diseases in adults. Signs of mild periodontal inflammation are usually present in adults, and 10 to 60% of middle-aged adults have severe enough periodontal disease that requires treatment.

For diagnosis, it is helpful to understand the appearance of healthy periodontal tissues. This chapter begins with a description of periodontal health and reviews the contribution of microbes and immune system to the cellular changes that lead to the signs and symptoms of periodontal diseases. This is followed by reviews of periodontal wound healing and tooth development, and their influences on periodontal disease and treatment.

Keywords: structure, microbes, cells, development

1.1 Learning Objectives

- Recognize normal anatomy of healthy periodontal tissue.
- Describe the contribution of microbes to the periodontal disease process.
- Describe cellular and molecular events that lead to clinical signs and symptoms of periodontal disease.
- Describe how periodontal tissue recovers from injury caused by bacteria or tissue trauma.
- Describe how tooth development influences periodontal disease and treatment.

1.2 Case

A 25-year old healthy female dental student is seen for a periodontal exam as part of a clinical peer-to-peer exercise. See ► Fig. 1.1 for clinical presentation and ► Fig. 1.2 for radiographic

presentation. She is currently satisfied with her dental condition, but had minor restorative treatment in the past and receives routine preventive dental care. She brushes and flosses regularly at least twice a day. These are the findings:

- **Soft tissue exam:** No pathology other than the presence of small lingual tori.
- **Tooth condition:** Small occlusal and interproximal amalgam restorations, and a slightly chipped maxillary incisor.
- **Periodontal measurements:** Probing depths less than 5 mm, no bleeding on probing, no clinical attachment loss, furcation involvement, tooth mobility, and gingival recession. The gingiva is coral pink with patches of light pink on the maxilla, firmly attached to underlying hard tissue and stippled. The gingival margin follows the contours of the teeth in a scalloped fashion, and no plaque or calculus is present.



Fig. 1.1 Clinical presentation for case.



Fig. 1.2 Radiographic series for case.

1 Background: Periodontal Disease Mechanisms and Wound Healing

Findings in the periodontal chart are as follows:

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Maxilla facial	PD		323	323	323	323	323	312	222	212	212	312	212	212	313	334	
	BOP																
	CAL		000	000	000	000	000	000	000	000	000	000	000	000	000	000	
	GR																
	MGJ		767	767	768	635	678	989	983	379	989	976	556	667	656	656	
	Furc																
	PLQ		0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Maxilla lingual	PD		324	323	324	323	223	112	111	111	112	112	212	212	213	224	
	BOP																
	CAL		000	000	000	000	000	000	000	000	000	000	000	000	000	000	
	GR																
	Furc																
	Mobil																
	PLQ		0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Mandible lingual		32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
	PD		324	323	212	212	211	111	111	111	111	212	212	212	312	313	
	BOP																
	CAL		000	000	000	000	000	000	000	000	000	000	000	000	000	000	
	GR																
	MGJ		999	999	876	756	656	656	656	656	656	656	667	888	999	999	
	Furc																
Mandible facial	PD		324	223	212	212	211	112	212	212	213	212	212	313	323	323	
	BOP																
	CAL		000	000	000	000	000	000	000	000	000	000	000	000	000	000	
	GR																
	MGJ		635	535	535	535	647	656	644	457	757	656	646	656	655	433	
	Furc																
	Mobil																
	PLQ		0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Abbreviations: BOP, bleeding on probing (1), suppuration (2); CAL; clinical attachment level; Furc, furcation involvement (Glickman class); GR, gingival recession; MGJ, position of the mucogingival junction from margin; Mobil, tooth mobility (Miller grade); PD, probing depths; PLQ, plaque level (0 = none, 5 = heavy).

What can be learned from this case?

This dental student displays a good example of **periodontal health**. The description of the gingiva matches characteristics of periodontal health. Periodontal health is most commonly seen in young, healthy adults who receive frequent preventive care and practice effective oral hygiene.

1.3 Periodontal Health

1.3.1 Characteristics of Healthy versus Diseased Periodontal Tissues

As seen in the previous case, periodontal health means absence of signs and symptoms of periodontal disease. No signs of inflammation are present in any area of the gingiva (see ► Fig. 1.1), and all gingival landmarks are easily visible and in normal proportion to each other. Landmarks and areas of gingiva and mucosa are named as shown in ► Fig. 1.3.

The case illustrates what periodontal health looks like, and clinical data matches many elements of periodontal health as shown in ► Table 1.1.

Most patients' periodontal disease experience will fall somewhere on a spectrum of periodontal disease between perfect periodontal health and severe disease, matching all characteristics listed in ► Table 1.1. The challenge for a clinician is to decide whether a patient has sufficient signs and symptoms of the disease to warrant treatment.

1.3.2 Healthy, but Reduced Periodontium

The case described in this chapter demonstrates a healthy periodontium in an individual who likely never experienced severe periodontal disease, as the tissues are intact with no evidence of gingival recession, attachment loss, and bone loss. It is possible to achieve periodontal health after periodontal therapy, but here the tissues may show signs of past disease activity. This

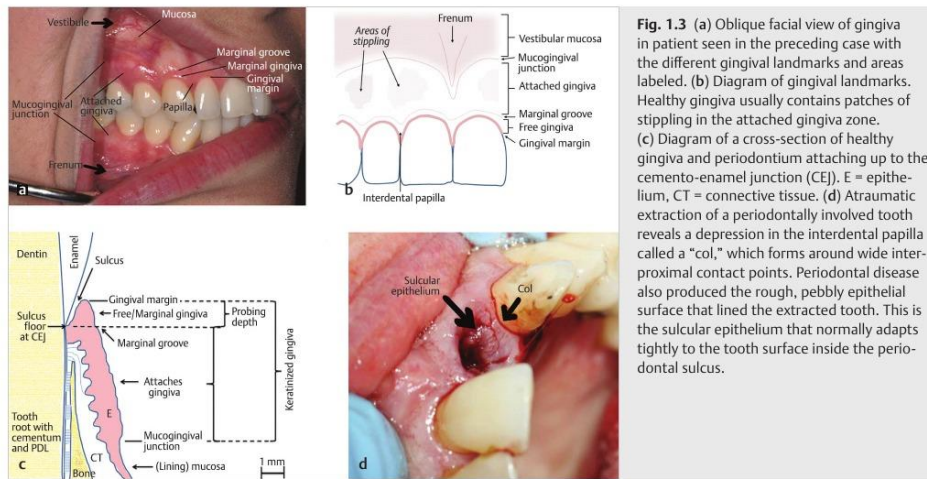


Fig. 1.3 (a) Oblique facial view of gingiva in patient seen in the preceding case with the different gingival landmarks and areas labeled. (b) Diagram of gingival landmarks. Healthy gingiva usually contains patches of stippling in the attached gingiva zone. (c) Diagram of a cross-section of healthy gingiva and periodontium attaching up to the cemento-enamel junction (CEJ). E = epithelium, CT = connective tissue. (d) Atraumatic extraction of a periodontally involved tooth reveals a depression in the interdental papilla called a "col," which forms around wide interproximal contact points. Periodontal disease also produced the rough, pebbly epithelial surface that lined the extracted tooth. This is the sulcular epithelium that normally adapts tightly to the tooth surface inside the periodontal sulcus.

Table 1.1 Findings in periodontal health vs. periodontal disease

		Healthy	Diseased
Symptoms		None	May complain about: Pain or soreness Receding gums Longer appearing teeth Loose teeth Red, swollen gum tissue Bleeds when brushing/eating
Gingival appearance/ signs of periodontal disease	Color	Coral—pink May have racial pigment	Erythematous ("red," "beefy red") May have slightly purple/bluish hue
	Firmness	Firm	Spongy, boggy, soft
	Shape	Pointed interproximal papilla Scalloped gingival margin Often shows marginal groove	Blunted, swollen papilla Loss of papilla Flattened scallop pattern Gingival swelling masks marginal groove
	Adaptation	Flat ("knife-edged") margin Tightly adapted to teeth	Edematous /Swollen ("rolled") margin Easily deflectable
	Other	Commonly has orange-peel texture ("stippling")	Smooth and shiny gingival margin May have fistula/sinus tracts Margin may be friable
Clinical measurements/ signs of periodontal disease	Probing depth	Low (1–3 mm usually)	High (>4 mm) Probing may be painful
	Gingival bleeding	None or insignificant	Present (at least 10% of sites)
	Clinical attachment	Intact (ideally 0 mm) Sulcus feels firm and tight	Loss of attachment (>0 mm, especially if interproximally)
	Tooth mobility	None (or little for mandibular incisors; small teeth; petite individuals)	May be easily detectable
	Recession	Ideally none	Common
	Amount of gingiva	Greater than probing depths	May be less than probing depth
	Furcation	Ideally none	Common
	Plaque	None to low	Clearly detectable
	Calculus	None to low	Clearly detectable
Radiographs		No bone loss	May have bone loss
Medical history		Typically healthy	Often has medical condition
Dental history		Usually has regular preventive care; frequent oral hygiene	Typically sporadic dental care and oral hygiene
Age		Typically younger	Typically older

1 Background: Periodontal Disease Mechanisms and Wound Healing

state is called "healthy, but reduced periodontium," and has the following characteristics:

- Low probing depths.
- Little (< 10% of sites) or no bleeding on probing.
- Clinical attachment levels greater than zero/presence of radiographic bone loss.
- Gingival recession may be present.
- Tooth mobility may be present.
- Often, has a history of past periodontal treatment.
- Likely needs continued periodontal preventive care to prevent disease recurrence.

"Periodontal health" can also be achieved in **edentulous** areas of the jaw as there is no tooth-soft tissue interface where periodontal disease can develop. Here, the residual gingiva, away from any teeth, will appear healthy and there is no disease activity other than slow ridge resorption from lack of use.

1.4 Anatomy, Histology, and Clinical Relevance

The anatomy and histology of periodontal tissues are important for diagnosis and disease development as shown here.

1.4.1 Relationship between Clinical Landmarks and Tissue Histology

Gingival landmarks are related to unique histologic features of each gingival area (see ► Fig. 1.3):

- **Marginal gingiva** or free gingiva consists of keratinized stratified squamous epithelium resting on a small area of connective tissue apical to it. There is no fiber attachment to the underlying tooth. This makes the free gingiva flexible, and allows the insertion of a periodontal probe. Since this area is closest to the tooth surface, this area will display the earliest signs of periodontal inflammation. In healthy tissues, the marginal groove usually corresponds to the level of the periodontal sulcus.

- **Attached gingiva** consists of a thick layer of stratified squamous keratinized epithelium that usually lack residual cell nuclei in the most superficial layer (orthokeratinized). On the hard palate, and occasionally in gingiva, the superficial layer may retain greatly reduced cell nuclei (parakeratinized). The epithelium is firmly attached to underlying dense connective tissue with interlocking tissue fingers (rete pegs), and the underlying dense connective tissue is firmly attached to the periosteum of alveolar bone and teeth through gingival fibers. In a **thin biotype**, the gingiva is thin, translucent, relatively smooth, and has long and thin, friable dental papillae. In a **thick biotype**, the gingiva is very thick and heavily stippled with a dense, fibrous connective tissue core, and has short, stubby interdental papillae.
- **Palatal gingiva** is similar to the attached gingiva found on facial surfaces, but may also contain minor salivary glands and islands of adipose tissue, loose connective tissue, nerves and blood vessels, in addition to dense connective tissue. The epithelium and dense connective tissue of the hard palate also tend to be thicker and denser than their facial gingiva counterpart, which makes the palatal gingiva lighter in color than facial gingiva, and makes it more difficult to reflect palatal gingiva during surgery.
- **Mucosa** is a soft, flexible tissue that covers most of the oral cavity and allows jaw, lip, and tongue movement. It consists of a relatively thin nonkeratinized squamous stratified epithelium that has shallow rete pegs and rests on a deep bed of loose connective tissue. Clinically, since the epithelium is thinner and so it is more transparent. This tissue appears darker than gingiva and contains numerous small surface blood vessels that are clearly visible.
- **Interdental papilla** consists of smooth, keratinized-stratified squamous epithelium, and dense connective tissue near the interproximal alveolar bone. For anterior teeth, the interdental papilla usually is pyramid-shaped, whereas, for posterior teeth, it is saddle-shaped around the contact point. The depression around the contact point is called a **col** (see ► Fig. 1.4). Periodontal disease usually starts

