Glickman's

# CLINICAL PERIODONTOLOGY

CARRANZA

*Glickman's*

# Clinical Periodontology

*PREVENTION, DIAGNOSIS AND TREATMENT OF PERIODONTAL DISEASE IN THE PRACTICE OF GENERAL DENTISTRY*

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# PREFACE
## to the Fifth Edition

Dr. Irving Glickman was a distinguished researcher and teacher whose dynamic personality, clear judgment, and profound knowledge of all areas of periodontics and related fields marked him as a leader in the progress of our discipline for three decades. This revision of his major work *Clinical Periodontology* has attempted to respect his basic concepts and approaches to the problems while incorporating new information and including recent findings that have shed light on previously obscure subjects.

This new edition of *Clinical Periodontology* incorporates all the major advances that have taken place in periodontics since the last edition while remaining a text aimed at the student and the practitioner.

After careful consideration, a major rearrangement of chapters was done in an attempt to coordinate the existing material and the new being added. In many cases, the new material made extensive revisions and rewriting of chapters necessary.

Fortunately, I was able to obtain the valuable help of a group of periodontists with remarkable expertise and knowledge in different clinical and research areas, to whom I am extremely grateful. Their excellent work, reflected in their contributions to the fifth edition of *Clinical Periodontology,* has been brought to fruition on the rich soil offered by the monumental task accomplished by Irving Glickman.

The group of distinguished collaborators to this fifth edition of *Clinical Periodontology* have contributed to different degrees in the various chapters.

*Dr. Alfred Weinstock* revised and updated the section on "The Tissues of the Periodontium" and also assisted in rewriting Chapter 6 on "Gingivitis." *Dr. Gerald Shklar* revised the chapter on "The Oral Manifestations of Dermatologic Disease," which now includes chronic desquamative gingivitis. *Dr. Vladimir Spolsky* revised and largely rewrote the chapter on epidemiology.

*Dr. Michael G. Newman* contributed to Chapter 13 on "Classification of Periodontal Disease" and rewrote the chapters on host response, the role of microorganisms, saliva, calculus, etc. He also wrote the section on antimicrobial therapy, included in Chapter 45. *Dr. William K. Solberg* revised and rewrote the chapters dealing with principles of occlusion and occlusal adjustment. *Dr. J. J. Carraro* revised the section on diabetes in Chapter 29.

*Dr. Henry H. Takei,* in collaboration with *Anna* and *Gordon Pattison,* prepared the chapters in Section III, Part II, dealing with instrumentation. *Dr. John Flocken* rewrote the section on electrosurgery. *Dr. Max O. Schmid* revised the chapter on plaque control and contributed Chapter 42 on tooth surface preparation. *Dr. Thomas N. Sims* updated the bibliography on bone grafts and reattachment. *Dr. E. Barrie Kenney* revised and rewrote extensive parts of the chapter on "Restorative-Periodontal Interrelationships." *Dr. Robert Merin* wrote Chapter 59 on "Results of Periodontal Treatment" and revised with extensive additions the chapter on "Maintenance Care."

I am indebted particularly to Drs. E. Barrie Kenney, Michael G. Newman, Max O. Schmid, and Henry H. Takei for their constructive criticism and constant support.

I also gratefully acknowledge the collaboration of Dr. Russell J. Nisengard, who read the chapter on host response and offered valuable suggestions; Dr. Sigmund S. Socransky, whose advice and guidance in the microbiology chapter were most helpful; and Dr. Sidney Finegold, who offered constructive criticism on the section on antimicrobial therapy.

Thanks are also due to the following colleagues who have contributed unpublished information or illustrations: Drs. R. Barbanell, R. G. Caffesse, R. Genco, R. Gibbons, A. G. Hannum, T. Hansson, L. Hirschfeld, T. Inage, J. Klingsberg, M. Listgarten, T. Oberg, R. Page, M. Ruben, Z. Skobe, J. Smulow, J. Sottosanti, J. VanHoute, and J. Yee.

I am also indebted to Mr. Alfred Strohlein; to Ms. Irene Petravicius for her excellent art work and untiring efforts to follow our ideas; to Ms. Catherine Boris, Mr. Richard L. Friske, and Mrs. Liliane Kennedy for the photographic material; to Ms. Ana Silberman and to Ms. Rhoda Freeman and the UCLA Word Processing Center (Ms. Michelle Kirsch, Ms. Mickey Kluchnik, and Ms. Barbara Mersini) for their excellent typing assistance; to the Hu-Friedy Company for supplying us with the instruments used for the illustrations in the section on instrumentation.

Special appreciation goes to Dr. Violeta Glickman for her confidence and her support, and to Mr. Carroll Cann, Ms. Laura Tarves, and Mr. Raymond Kersey and the W. B. Saunders Company for their trust and expertise.

Last but not least, my thanks go to my wife, Rita, and my three children, Fersy, Patricia, and Laura, for bearing with me through the period during which this work was done.

FERMIN A. CARRANZA, JR.
*Los Angeles, California*

# PREFACE
## to the First Edition

This is a textbook for practitioners of general dentistry and students preparing to be general practitioners. It was the author's desire to create an analytical text, fostered by a critical objectivity. An effort has been made to differentiate between fact and unsubstantiated hypothesis. This constitutes a challenge, especially when it means parting with tradition. However, difficult though it may be, it is sometimes necessary to guard against the hampering influence of habit which tends to nudge us along the well-traveled pathways of thought.

This book is predicated on the premise that the periodontal care of the American public is primarily the concern of the practitioner of general dentistry. The establishment of periodontia as a specialty should be a stimulus for improved periodontal care by the general practitioner. The existence of a group of dentists who desire to limit their practices or specialize in periodontia cannot be hailed as a sign that the obligation of the general practitioner in regard to periodontal problems is diminished. If anything, the opposite is true. The existence of individuals with a primary interest in cardiology who limit their practices accordingly has not meant that medical schools have diminished their teaching of the anatomy and physiology of the heart and the diagnosis and management of cardiac dysfunction—or that practitioners of general medicine have discarded their stethoscopes.

The need for training the general practitioner so that he can fulfill his responsibility to provide periodontal care for all his patients has stimulated a reorientation in the philosophy of dental education and intensification in the teaching of periodontology at both the undergraduate and postgraduate levels. The general practitioner should know enough to handle most periodontal problems which confront him. The availability of a well-trained group of specialists for unusual problems should serve to supplement the dental care available to our population. The establishment of periodontia as a specialty and continued improvement in the ability of the general practitioner to cope with periodontal problems are interdependent movements—mutually dependent upon each other for continued stimulation and progress.

Much information is available regarding the nature of periodontal disease and its treatment. Many problems are as yet unsolved. The existing status of knowledge does not warrant an attitude of complacency. On the other hand, a sizable accumulation of knowledge has

resulted from the industry of clinicians and research workers. A considerable portion of this information is applicable in the practice of dentistry. It is the purpose of this textbook to present existing knowledge regarding periodontal problems in such a manner that it can be incorporated in the practice of general dentistry. It was planned with the following objectives in mind:

The application of basic principles of periodontology in the prevention, diagnosis and treatment of periodontal disease.

An appreciation of the extent to which the initiation of periodontal disease and tooth loss from pathological destruction of the periodontal tissues can be prevented.

An evaluation of the interrelation of local and systemic factors in the causation of periodontal disease.

An appreciation of the effect of treatment procedures upon the tissue changes underlying clinical disease.

The presentation of treatment techniques that can be performed with the degree of skill possessed by every qualified practitioner of general dentistry.

An explanation of the application of various treatment techniques to specific clinical periodontal problems.

The clarification of the interrelation of clinical periodontal procedures with the other aspects of general dentistry.

It has been the experience of the author that the type of preparation which dental students and dentists engaged in graduate and postgraduate training find most useful in the clinical management of periodontal problems is an understanding of clinical phenomena in terms of underlying tissue changes. All clinical periodontal problems are basically gross expressions of microscopic tissue changes. The microscopic changes underlying clinical periodontal disease are essentially manifestations of the composite effects of disease-causing factors. The effectiveness of treatment procedures is reflected in terms of microscopic tissue changes. It is understandable why the interpretation of clinical phenomena in terms of tissue changes is of such practical value in the periodontal field. Crystallization of the clinical management of periodontal problems in terms of microscopic tissue changes is therefore the keynote of this book.

Terminology in the periodontal field is still in a somewhat unsettled state. Conscientious efforts are in progress to clarify this situation. Disagreement over terminology tends to divert attention from more basic considerations. Emphasis is therefore placed upon the explanation of the nature of various conditions, rather than upon the terms by which they are designated.

IRVING GLICKMAN
*Boston, Massachusetts*
*1953*

# CONTENTS

## *Section 1*

# THE TISSUES OF THE PERIODONTIUM

The periodontium is the investing and supporting tissues of the tooth, and consists of the *periodontal ligament,* the *gingiva, cementum,* and *alveolar bone.* The cementum is considered a part of the periodontium because, with the bone, it serves as the support for the fibers of the periodontal ligament. The periodontium is subject to morphologic and functional variations as well as changes with age. This section deals with the normal features of the tissues of the periodontium, knowledge of which is necessary for an understanding of periodontal disease.

# The Gingiva



The *oral mucosa* consists of the following three zones: the gingiva and the covering of the hard palate, termed the masticatory mucosa; the dorsum of the tongue, covered by specialized mucosa; and the oral mucous membrane lining the remainder of the oral cavity. The *gingiva* is that part of the oral mucosa that covers the alveolar processes of the jaws and surrounds the necks of the teeth.

## NORMAL CLINICAL FEATURES

The gingiva is divided anatomically into the marginal, attached, and interdental areas.

### The Marginal Gingiva (Unattached Gingiva)

The marginal ("unattached") gingiva is the terminal edge or border of the gingiva surrounding the teeth in collar-like fashion (Fig. 1–1) and demarcated from the adjacent attached gingiva by a shallow linear depression, the *free gingival groove.*[1] Usually slightly more than a millimeter wide, it forms the soft tissue wall of the gingival sulcus. It may be separated from the tooth surface with a periodontal probe.

THE GINGIVAL SULCUS. The gingival sulcus is the shallow crevice or space around the tooth bounded by the surface of the tooth on one side and the epithelium lining the free margin of the gingiva on the other. It is V-shaped and barely permits the entrance of a periodontal probe. The average depth of the normal sulcus has been reported as 1.8 mm., with a variation of from 0 to 6 mm.[93] Other studies show 2 mm.,[12] 1.5 mm.,[149] and 0.69 mm.[38] Gottlieb considered the "ideal" sulcus depth to be zero.[46]

### The Attached Gingiva

The attached gingiva is continuous with the marginal gingiva. It is firm, resilient,

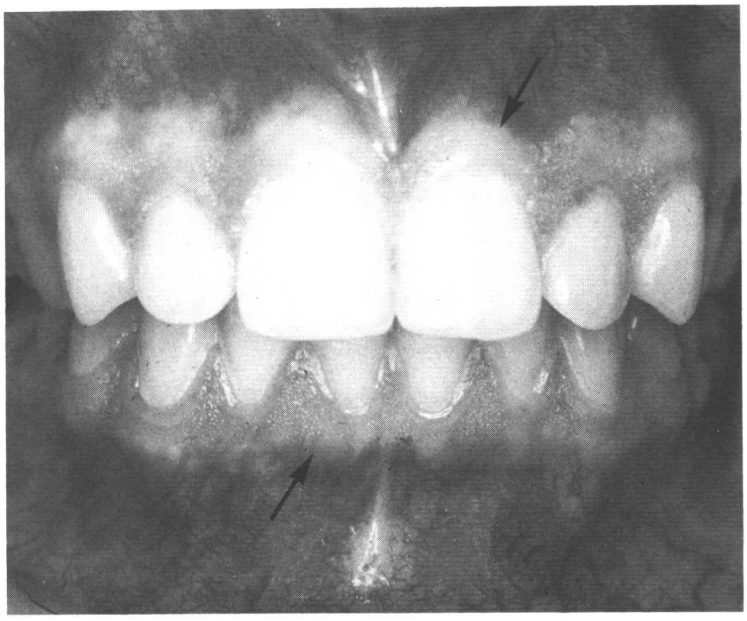

**Figure 1–1 Normal Gingiva in Young Adult.** Note the demarcation (mucogingival line) between the attached gingiva and darker alveolar mucosa.

and tightly bound to the underlying periosteum of alveolar bone. The facial aspect of the attached gingiva extends to the relatively loose and movable *alveolar mucosa* from which it is demarcated by the *mucogingival junction* (Fig. 1–2). The width of the attached gingiva on the facial aspect in different areas of the mouth varies from less than 1 mm. to 9 mm.[11] On the lingual aspect of the mandible, the attached gingiva terminates at the junction with the lingual alveolar mucosa, which is continuous with the mucous membrane lining the floor of the mouth. The palatal surface of the attached gingiva in the maxilla blends imperceptibly with the equally firm, resilient palatal mucosa.

## The Interdental Gingiva

The interdental gingiva occupies the *gingival embrasure*, which is the interproximal space beneath the area of tooth contact. It usually consists of two papillae, one facial and one lingual, and the *col.*[20] The latter is a valley-like depression which connects the papillae and conforms to the shape of the interproximal contact area (Figs. 1–3 and 1–4). When teeth are

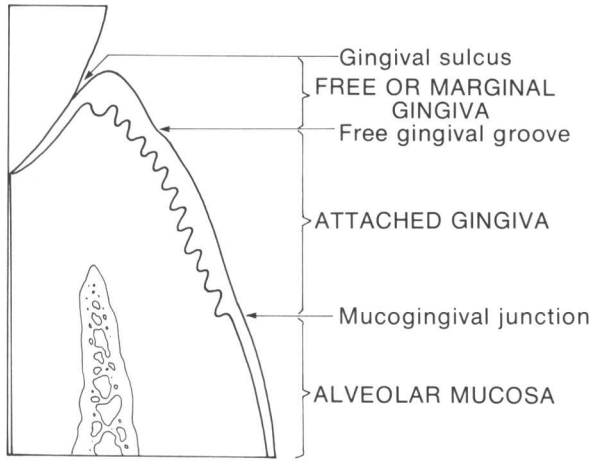


**Figure 1–2** Diagram showing anatomical landmarks of the gingiva.

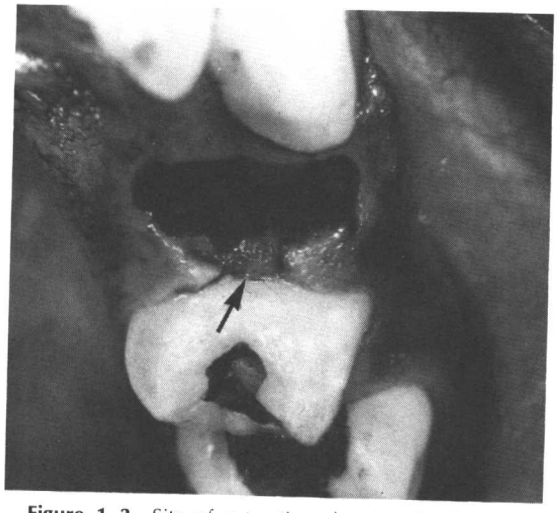

**Figure 1–3** Site of extraction showing the facial and palatal interdental papillae and the intervening col (*arrow*).

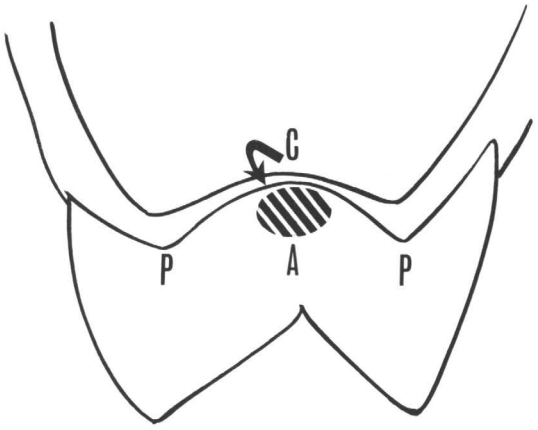


**Figure 1–4** Interdental papillae (P), col (C), and relationship to contact area (A) on mesial surface.

not in contact, the col is often absent. Even when teeth contact, the col may be absent in some individuals (Fig. 1–5).

Each interdental papilla is pyramidal; the facial and lingual surfaces are tapered toward the interproximal contact area, and the mesial and distal surfaces are slightly concave. The lateral borders and tip of the interdental papillae are formed by a continuation of the marginal gingiva from the adjacent teeth. The intervening portion consists of attached gingiva (Fig. 1–6).

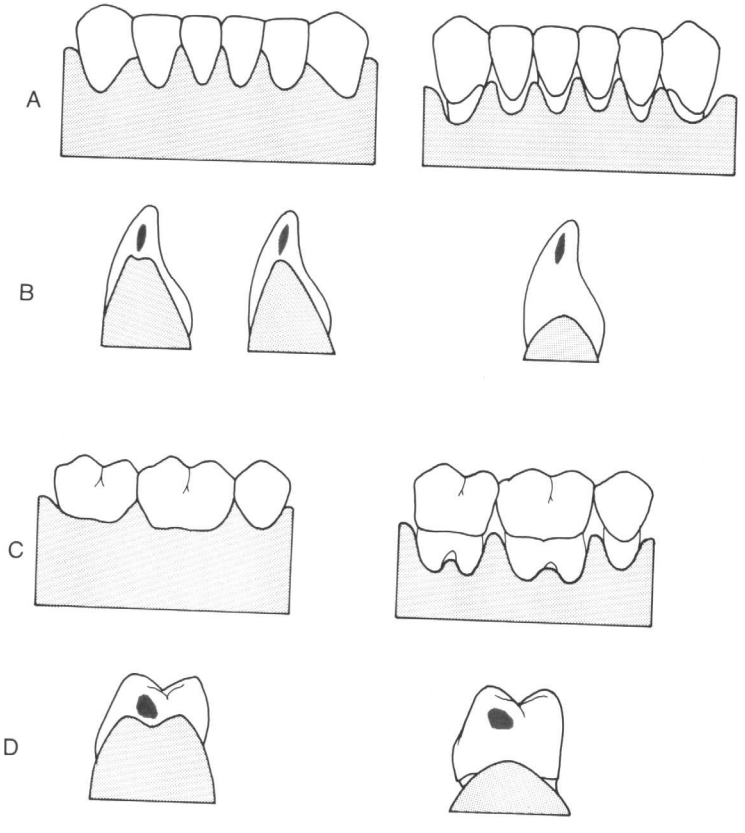


**Figure 1–5** Diagram comparing anatomical variations of the interdental col in the normal gingiva (left side) and after gingival recession (right side). *A* and *B*, Mandibular anterior segment, facial and buccolingual views, respectively. *C* and *D*, Mandibular posterior region, facial and buccolingual views, respectively. Tooth contact points are shown in *B* and *D*.

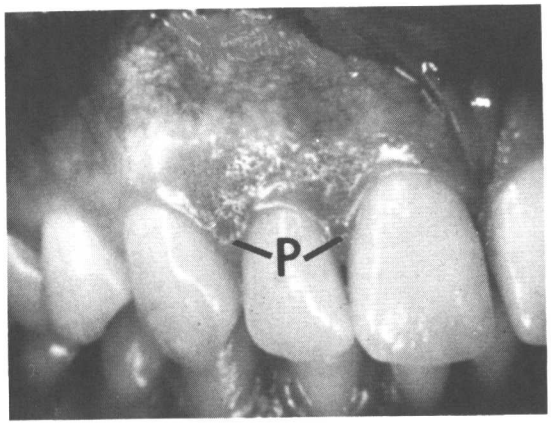


**Figure 1–6 Interdental Papillae with Central Portion Formed by Attached Gingiva.** The shape of the papillae (P) varies according to the dimension of the gingival embrasure.

In the absence of proximal tooth contact, the gingiva is firmly bound over the interdental bone and forms a smooth rounded surface without interdental papillae (Fig. 1–7).

## NORMAL MICROSCOPIC FEATURES

### The Marginal Gingiva (Unattached Gingiva)

The marginal gingiva consists of a central core of connective tissue covered by stratified squamous epithelium (Fig. 1–8). The epithelium on the crest and outer surface of the marginal gingiva is keratinized, parakeratinized or both, contains prominent rete pegs or ridges and is continuous with the epithelium of the attached gingiva. The epithelium along the inner surface (facing the tooth) is devoid of rete pegs, is neither keratinized nor parakeratinized, and forms the lining of the gingival sulcus.

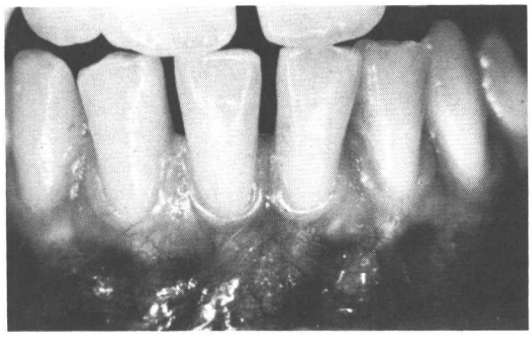

**Figure 1–7** Absence of interdental papillae and col where proximal tooth contact is missing.

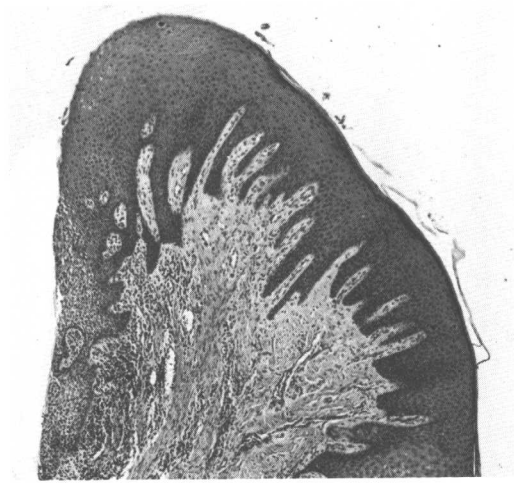

**Figure 1–8 Section of Clinically Normal Gingiva,** showing inflammation which is almost always present near the base of the sulcus. Keratin strands are visible on the outer surface, where they have been displaced due to artifact.

### The gingival fibers

The connective tissue of the marginal gingiva is densely collagenous, containing a prominent system of **collagen fiber bundles** called the gingival fibers. The gingival fibers have the following functions: to brace the marginal gingiva firmly against the tooth; to provide the rigidity necessary to withstand the forces of mastication without being deflected away from the tooth surface; and to unite the free marginal gingiva with the cementum of the root and the adjacent attached gingiva. The gingival fibers are arranged in three groups: gingivodental, circular, and transseptal.[3, 35]

GINGIVODENTAL GROUP. These are the fibers of the facial, lingual, and interproximal surfaces. They are embedded in the cementum just beneath the epithelium at the base of the gingival sulcus. On the facial and lingual surfaces they project from the cementum in fanlike conformation toward the crest and outer surface of the marginal gingiva and terminate short of the epithelium (Figs. 1–9 and 1–10). They also extend external to the periosteum of the facial and lingual alveolar bone and terminate in the attached gingiva or blend with the periosteum of the bone. Interproximally, the gingivodental fibers extend toward the crest of the interdental gingiva (Fig. 1–8).

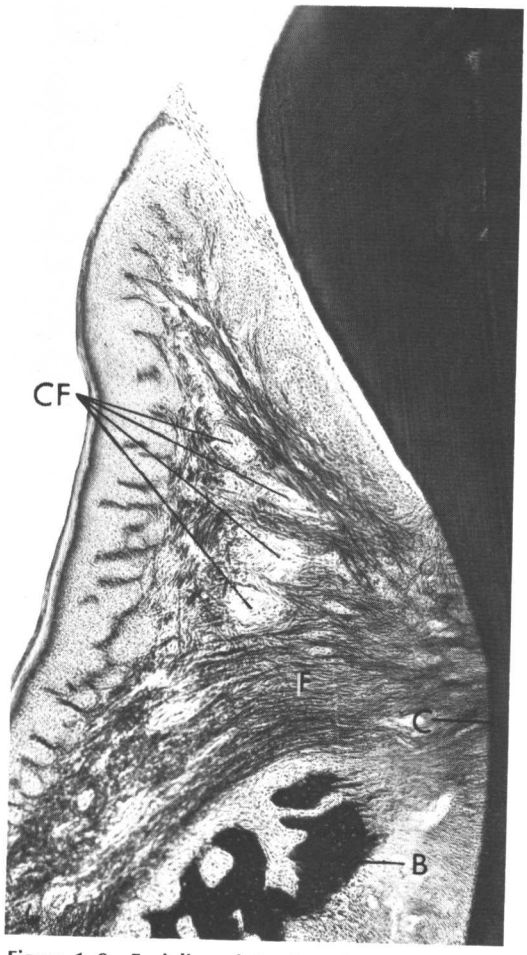


**Figure 1–9 Faciolingual Section of Marginal Gingiva,** showing gingival fibers (F) extending from the cementum (C) to the crest of the gingiva, to the outer gingival surface, and external to the periosteum of the bone (B). Circular fibers (CF) are shown in cross section between the other groups. (Courtesy of Dr. Sol Bernick.)

CIRCULAR GROUP. These fibers course through the connective tissue of the marginal and interdental gingiva and encircle the tooth in ringlike fashion.

TRANSSEPTAL GROUP. Located interproximally, the transseptal fibers form horizontal bundles that extend between the cementum of approximating teeth into which they are embedded. They lie in the area between the epithelium at the base of the gingival sulcus and the crest of the interdental bone and are sometimes classified with the principal fibers of the periodontal ligament.

CONNECTIVE TISSUE CELLULAR ELEMENTS. The preponderant cellular element in the gingival connective tissue is the fibroblast. Numerous fibroblasts are found between the fiber bundles. As in connective tissue elsewhere in the body, fibroblasts synthesize and secrete the collagen fibers, as well as elastin, the non-collagenous proteins, glycoproteins, and glycosaminoglycans. The renewal of collagen fibers and other chemical constituents, and possibly their degradation, is regulated by fibroblasts. Wound healing following gingival surgery or as a result of injury or pathological processes is also regulated by gingival fibroblasts.

Mast cells, which are distributed throughout the body, are numerous in the connective tissue of the oral mucosa and

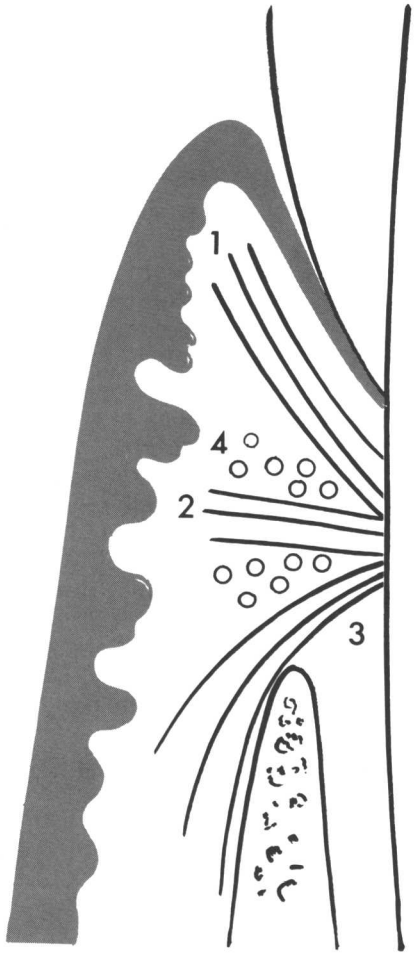


**Figure 1–10 Diagrammatic Illustration of the Gingivodental Fibers** extending from the cementum (1) to the crest of the gingiva, (2) to the outer surface, and (3) external to the periosteum of the labial plate. Circular fibers (4) are shown in cross section.