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Periodontal Surgery for Root Coverage

A step-by-step guide

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the best minds in your field,
and you're bound to succeed.

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Foreword

When I was invited to write the foreword for the English version of “Periodontal Surgery for Root Coverage,” published by Liaoning Science and Technology Publishing House, I was in for a few surprises. First, it is an illustrated, beautifully printed, carefully authored high-level oral medicine monograph; second, it was written by the five young scholars, Qi Liu, Haidong Zhang, Xia Yan, Jingwen Yang, and Chao Suo. This is a breakthrough in the history of the publication of Chinese dental monographs, considering the young age of the authors. Third, all the cases shown in the book are the authors’ own clinical cases, and the exquisite illustrations were created by the authors and collaborators of this book. Finally, it was not only published in Chinese; this book was to be published in English by the internationally renowned Quintessence Publishing Company. I am very happy for these four young Chinese dental experts! I hope the English version of this book is well received by their international colleagues.

This monograph describes in detail the common surgical procedures for natural root surface coverage, with accurate descriptions of the anatomical, histologic, physiologic, and pathologic aspects. Each step of root coverage surgery is described, with a large number of exquisite clinical photographs and illustrations. The relevant scientific literature of the important theories is clearly shown in dialog boxes. This is not only convenient for readers, but also reflects the rigorous scientific attitude of the authors. This book provides an introduction and systematic summary of a series of root coverage techniques, and will undoubtedly play an active role in standardizing and popularizing the technology of root surface coverage.

This book focuses on periodontal health, which is not only an important part of oral health, but also has a very close relationship with the occurrence and prognosis of systemic diseases. The fourth National Oral Health Survey, recently conducted in China, was not optimistic about the periodontal health status of Chinese residents, especially as there has been an obvious increase in the incidence of periodontal disease among the middle-aged. Therefore, great importance must be attached to periodontal health. In our oral medical practice, periodontal health is a prerequisite for successful restorative,

Foreword

orthodontic, and implant treatment. The treatment of gingival recession and root surface exposure during the everyday treatment of periodontal disease has become a hot topic in recent years. This book will help general dental practitioners to gain the relevant knowledge and understanding to treat periodontal disease, gingival recession, and root exposure, in order to ensure periodontal health and good esthetics for their patients.

Thanks to the authors for, outside of their busy clinical schedule, their careful organization in accumulating case information and studying the literature. Thanks also to our old friend, Mr Haase, Publisher at Quintessence Publishing Company, who provided the opportunity for this English version. It is hoped that Chinese dentistry and Quintessence Publishing will have many more opportunities for cooperation, showcasing the cutting-edge clinical research achievements of Chinese dental scholars, and contributing to the progress and development of oral medicine.

Dr Xing Wang
Honorary President, Chinese Stomatological Association
Professor, Peking University School of Stomatology
23 May 2018, Beijing, China





Foreword

Dear Dr Liu,

Congratulations on your new book. I am happy to see that you were encouraged to complete your book on soft tissue and also happy that my material has been a base for your knowledge in helping you complete the book. I would like to wish you all the best.

Yours sincerely,
Dr Inaki Gamborena



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Preface

Health, function, and esthetics are the three eternal themes of dental treatment. The prerequisite for good esthetics is the health and long-term stable function of the dental, periodontal, and even the entire maxillo-mandibular system. Under the premise of satisfactory health and function, long-lasting esthetics depends on the coordination of the white and pink esthetic elements. In the face of gingival recession, presenting commonly as a “wedge-shaped defect,” it may be possible to skillfully place a filling in this Class V lesion, but when the complaint is “My teeth are too long,” are other solutions available? When treating a dental fluorosis patient, we may be able to create perfect white esthetic veneers, but when the patient laughs and shows a slight discrepancy at the gingival margin, causing them dissatisfaction, can we offer a more perfect result to satisfy the patient? It seems that a defect of 1 to 2 mm at the gingival margin has become the stumbling block for many dental practitioners in the pursuit of perfect white esthetics. Mucogingival surgeries, such as root coverage, are the key to overcoming this obstacle.

This book was written with general dental practitioners in mind, those who have mastered basic periodontal treatment and basic surgical skills and are willing to engage in soft tissue treatment such as periodontal root coverage. The intention was to provide a single reference that includes the related key anatomical and histologic points of root coverage procedures, with a brief review of the development of this technique, as well as the principles and mechanisms of the main surgical methods, and introducing the indications and main steps for coronally advanced flaps, the tunnel technique, and the two-stage technique.

An important precondition is that the reader must master standard periodontal treatment and basic surgical skills before attempting periodontal root coverage. We hope to provide a “shortcut” for general dental practitioners who have not systematically trained in periodontology, but this does not mean that clinicians can do without the basic knowledge and understanding of the concepts of root coverage, and simply focus on conducting the surgery. Our colleagues have often asked us whether root coverage surgery is the right



choice for their patient. Unfortunately, for a few of these cases, adjacent teeth were covered with plaque or had swollen papillae. Trying to reflect a flap and graft tissue on such gingiva is tantamount to climbing a tree to catch a fish, so how could an ideal and long-lasting treatment be achieved? We emphasize that this book is a “step-by-step” atlas. It is hoped that readers have already gained the necessary experience step-by-step before hoping to understand these specific techniques.

It should be pointed out that although the starting point for this book is a “step-by-step” operation atlas, we still emphasize that all root coverage surgery options and clinical decisions must be based on clinical evidence and analysis, made on the premise of good communication between the dental practitioner and the patient. To this end, while focusing the text as much as possible, we have reviewed some of the classic articles on root coverage in detail, summarizing and presenting them to the readers using annotations. We hope that readers will ask “why,” so that those who want more than these basic theories and introduced techniques, and are eager to understand other periodontal mucogingival surgeries, can use this atlas as a starting block to dive into the larger treasures in this field.

Special thanks to Mr. Gang Chen, the Editor-in-Chief of Quintessence Publishing in China, who helped with the publication of this book, and for his dedication and great achievements in the world of high-quality dental textbook publication.

Qi Liu, Haidong Zhang, Jingwen Yang, Xia Yan, and Chao Suo
October 2019



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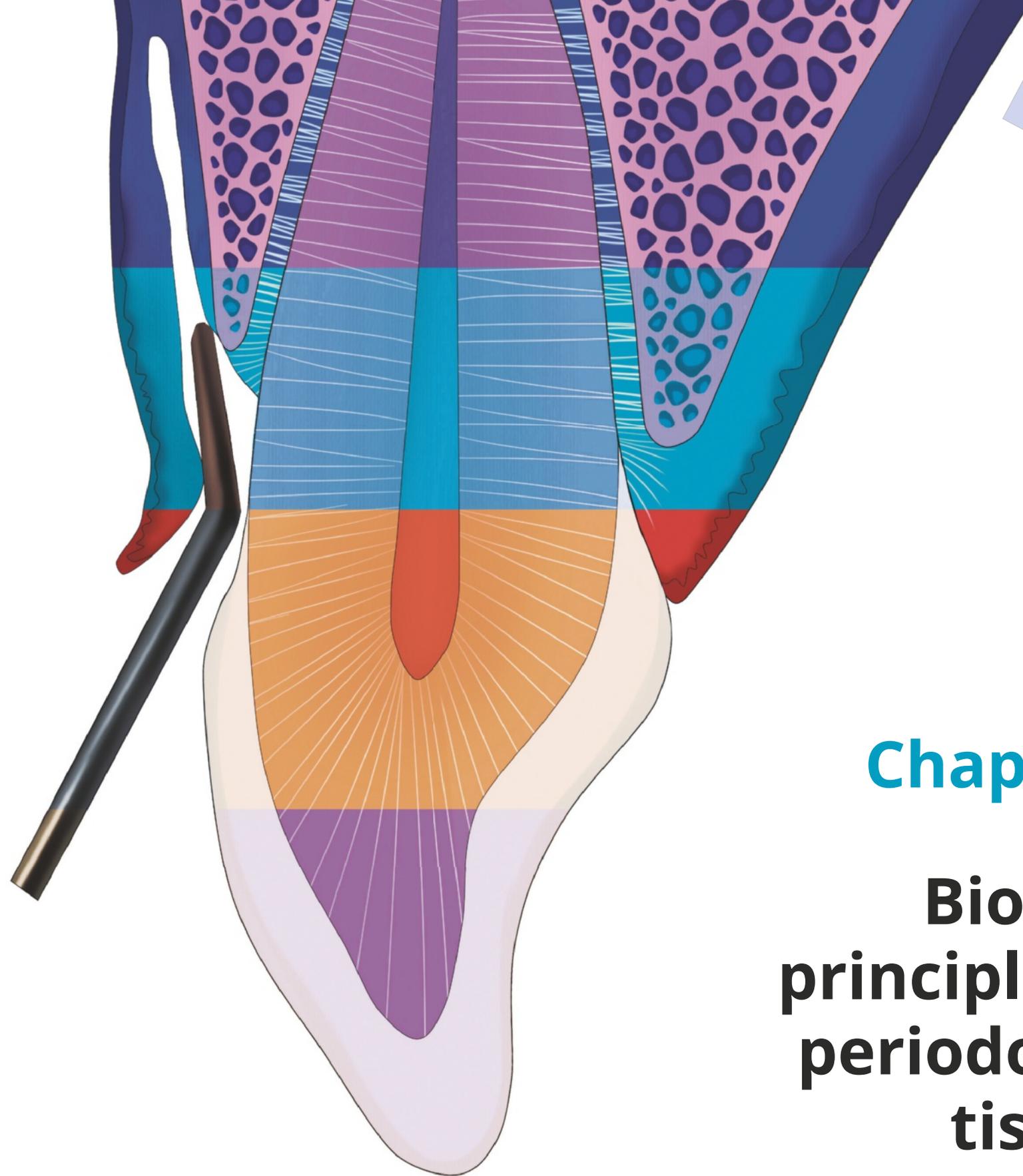
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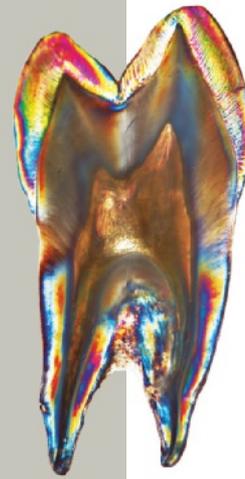




Chapter 1

Biologic principles of periodontal tissues

This book focuses on treating defects in the soft tissue, such as the gingiva and alveolar mucosa, surrounding the teeth.





Periodontal surgery for root coverage literally requires “covering” the root surface, which has become exposed as a result of gingival recession. Gingival recession (Fig 1-1) is the movement of the gingival margin from its originally physiologic position (1 to 2 mm apical of the cemento-enamel junction [CEJ]) towards the apex, resulting in pathologic exposure of the root surface.

In the esthetic zone, gingival recession and subsequent root surface exposure leads to esthetic problems, noticed by patients as “longer teeth,” especially those with high smile lines.

For patients without cementum coverage on the exposed root surface, gingival recession can cause severe sensitivity from thermal or mechanical stimulation. As a result, patients can fear cleaning the exposed root surface. With the progression of gingival recession, the already insufficient keratinized gingiva may totally disappear. It can therefore become difficult for patients to maintain proper oral hygiene in these areas.



Class I	Class II
Class III	Class IV



Fig 1-1 Miller's classification of gingival recession (Miller, 1985).



The indications for periodontal root coverage surgery include:

- esthetic problems caused by gingival recession
- hypersensitivity of root surface dentin
- difficulties in maintaining oral hygiene caused by deficiency in keratinized mucosa.

It should be noted that dentin hypersensitivity can be improved by nonsurgical desensitization therapy. The dental practitioner should choose first the least invasive approach, unless further intervention is required.

If clinicians intend to treat dentin hypersensitivity by root surface coverage, they must first understand the anatomy and histology of the mucosa, gingiva, periodontal ligament (PDL), cementum, and alveolar bone.



1.1 Anatomy and histology of the periodontium

The anatomical apparatus involved in the surgery for root coverage comprises the gingiva, alveolar mucosa, PDL, alveolar bone, and cementum.

The oral mucosa consists of masticatory mucosa, lining mucosa, and specialized mucosa. The gingiva and hard palate are masticatory mucosa. Alveolar mucosa, buccal mucosa, and labial mucosa make up the lining mucosa. The dorsal surface of the tongue is covered by specialized mucosa that sense taste.

The periodontal tissues (periodontium) include the gingiva, PDL, alveolar bone, and cementum. Figure 1-2 illustrates the periodontal anatomy.

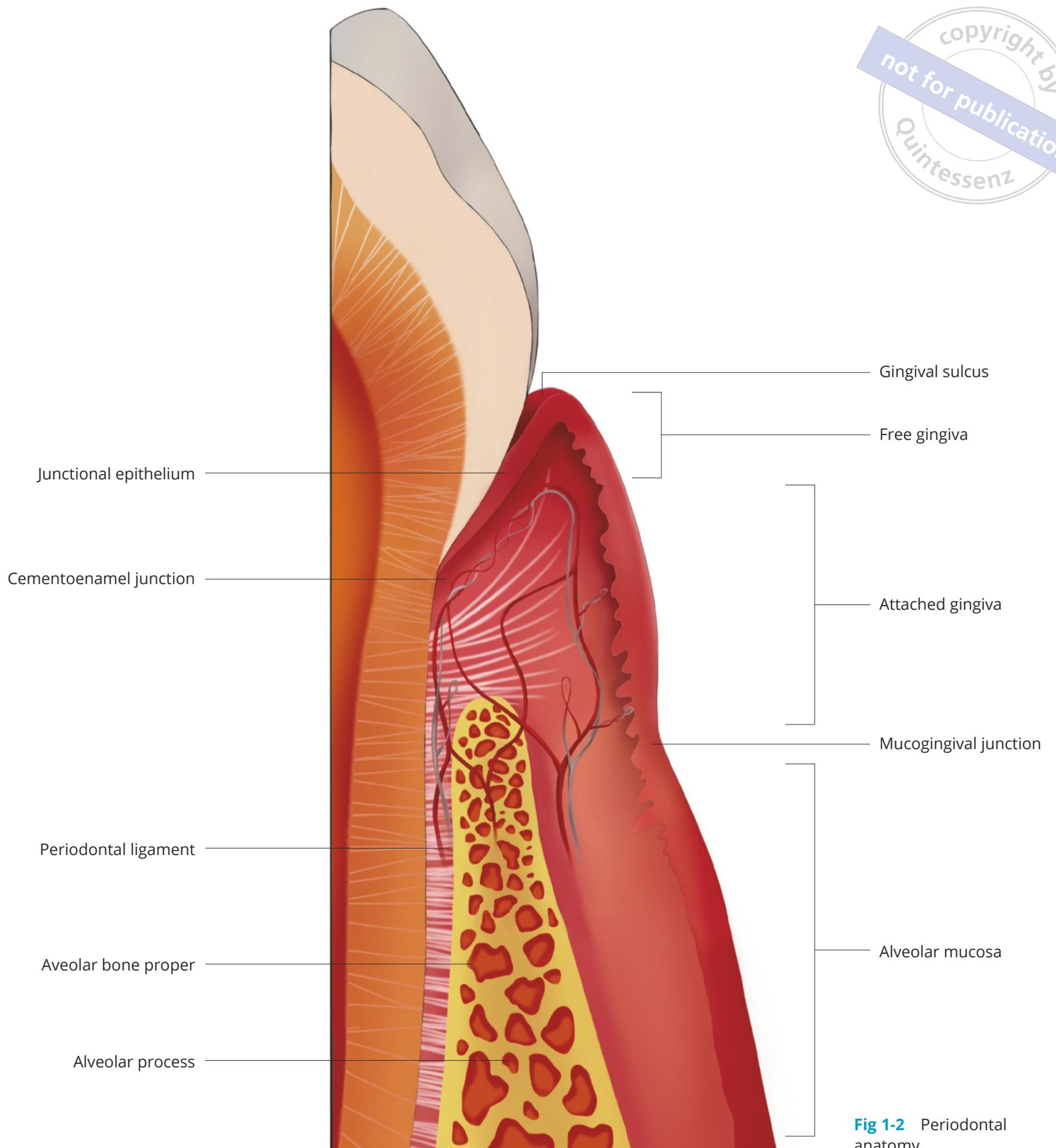


Fig 1-2 Periodontal anatomy.



1.2 Gingiva



According to the anatomical features, gingiva can be divided into three parts: free or marginal gingiva, attached gingiva, and interdental papilla (Fig 1-3).

Free gingiva surrounds the cervical portion of the teeth, and has a scalloped margin due to the interdental papillae.

The apical end of free gingiva extends to the attached gingiva, which is firm and tightly bound to the periosteum of the alveolar bone. There can be stippling or an orange peel appearance on the buccal surface of the attached gingiva.

Fig 1-3 Healthy gingiva (maxillary anterior teeth).

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Ainamo et al (1992) performed longitudinal follow-up for 18 years of patients who received a coronally advanced flap. They proposed that "the position of the mucogingival junction remains substantially stable throughout life time." This also explains why the width of keratinized gingiva gradually increases after a coronally repositioned flap for root coverage.

Ainamo A, Bergenholtg A, Hugoson A. Location of the mucogingival junction 18 years after apically repositioned flap surgery. J Clin Periodontol 1992;19:49-52.

The attached gingiva is apically connected to the darker red and less firmly attached alveolar mucosa at the mucogingival junction. The position of the mucogingival junction remains substantially stable throughout life (Ainamo et al, 1992). The width of the attached gingiva varies greatly with age and in different regions of the mouth.

According to a study published by Ainamo and Talari (1976), comparing the same teeth, 40- to 50-year-old patients had wider attached gingiva than 20- to 30-year-old patients. This phenomenon may relate to the continuous passive eruption of teeth during aging. Studies by Maynard and Ochsenein (1975) have shown that the more buccal the position of the tooth in the arch, the narrower the buccal attached gingival will be.



Fig 1-4 Labial view, gingiva of maxillary anterior teeth.



Fig 1-5 Palatal view, gingiva of maxillary anterior teeth.



Fig 1-6 Lingual view, gingiva of mandibular anterior teeth.

The interdental papilla is pyramidal in shape and fills the embrasure between two adjacent teeth. The exact shape of the interdental papilla is formed by the contour of two adjacent teeth, contact area, and the alveolar bone (Fig 1-7). A valley-shape can form at the papilla, forming a col that is covered by nonkeratinized epithelium and is weak to external microbes and noxious agents. The col is usually the region in which periodontal disease begins (Figs 1-8 and 1-9).



Fig 1-7 Anterior view, gingival papilla of maxillary anterior teeth.

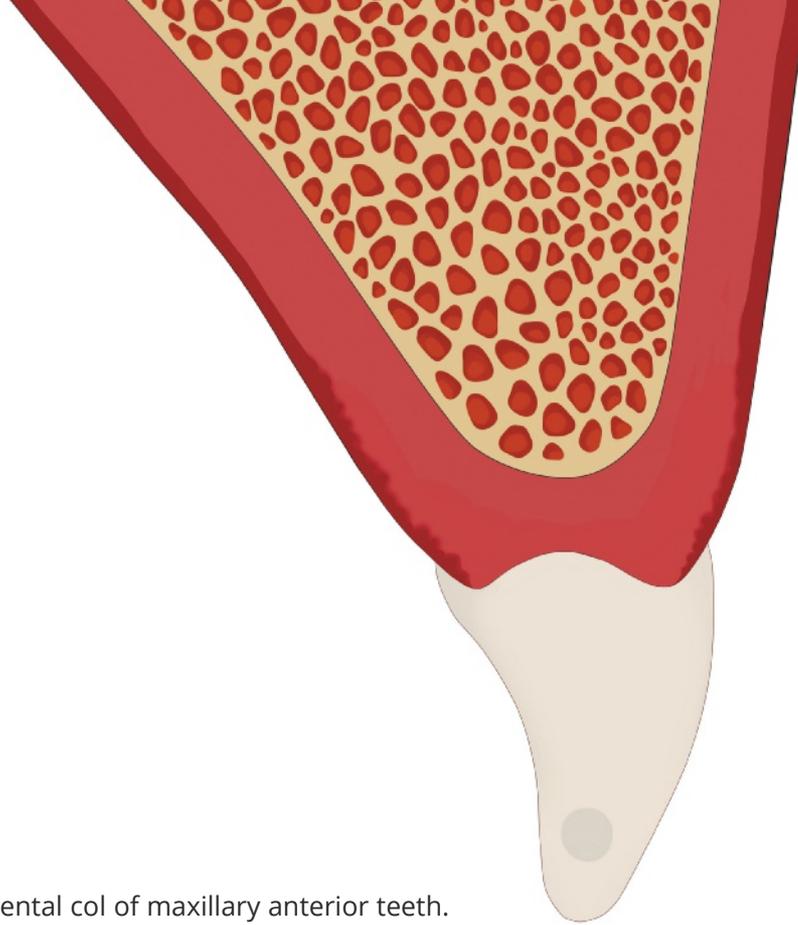


Fig 1-8 Illustration of interdental col of maxillary anterior teeth.

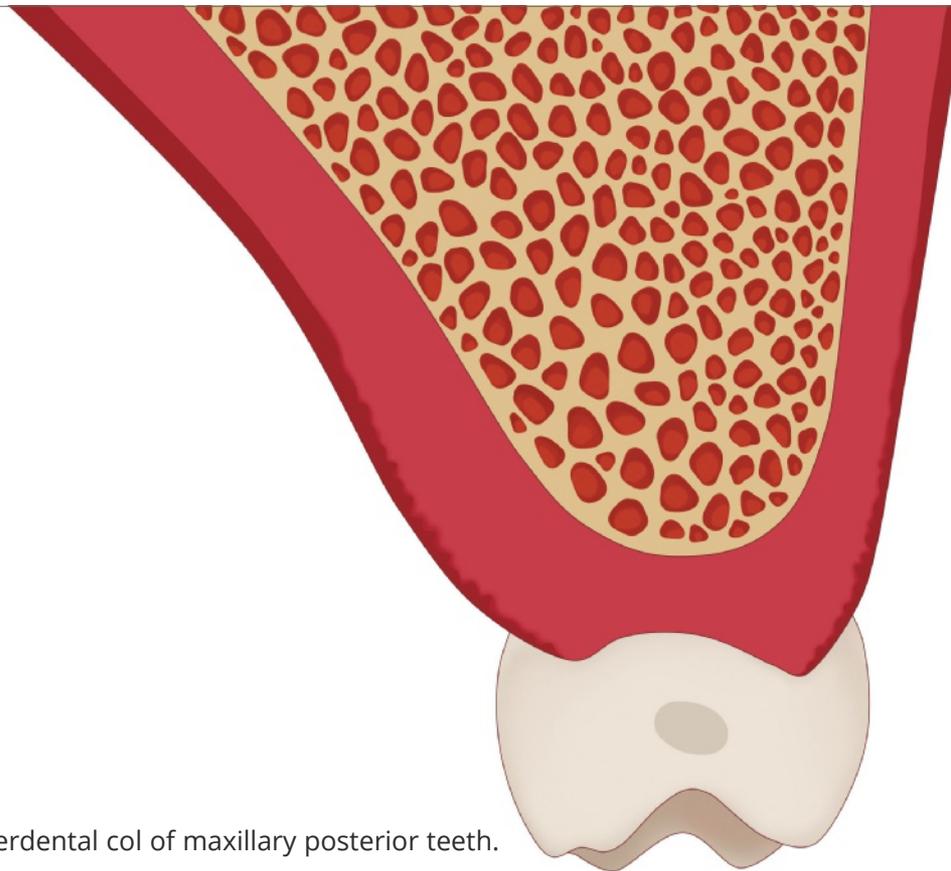


Fig 1-9 Illustration of interdental col of maxillary posterior teeth.

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By measuring 288 sites in 30 patients, Tarnow et al (1992) found that nearly 100% of the papillae can be filled completely when the distance from the alveolar crest to the interproximal contact point between the two adjacent teeth is less than 5 mm. When the distance is 6 mm, 56% of the sites can be fully filled; when it is ≥ 7 mm, only 27% of the papillae can completely fill the embrasure.

Tarnow DP, Magner AW, Fletcher P. The effect of the distance from the contact to the crest of bone on the presence or absence of the interproximal dental papilla. J Periodontol 1992;63:995-996.

The height of papilla is an important factor in assessing the esthetics of anterior teeth. One of the decisive factors for the integrity of the papilla is the distance from the alveolar crest to the interproximal contact point. When the distance is less than 5 mm, the papilla can basically fill up the interproximal embrasure. When it exceeds 5 mm, the embrasure may not be fully filled (Figs 1-10 and 1-11).

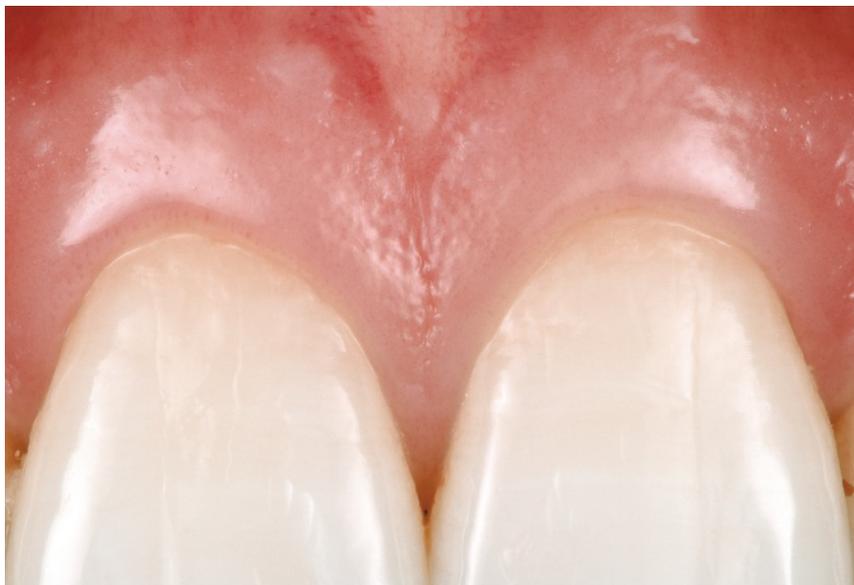


Fig 1-10 Labial view, gingiva of maxillary anterior teeth without papilla defect.



5 mm

Fig 1-11 Radiograph shows 5 mm distance from the alveolar crest to the contact point.



From a histologic point of view, the gingiva comprises the gingival epithelium and the connective tissue beneath; both cover the alveolar process and surround the cervical portion of the teeth.

The gingival epithelium includes the oral epithelium, the sulcular epithelium, and the junctional epithelium. The oral epithelium is stratified, keratinized squamous epithelium. From the edge of the free gingiva, along the outer surface of the attached gingiva, to the mucogingival junction is covered by the oral epithelium, clinically called "keratinized gingiva" (Fig 1-12).

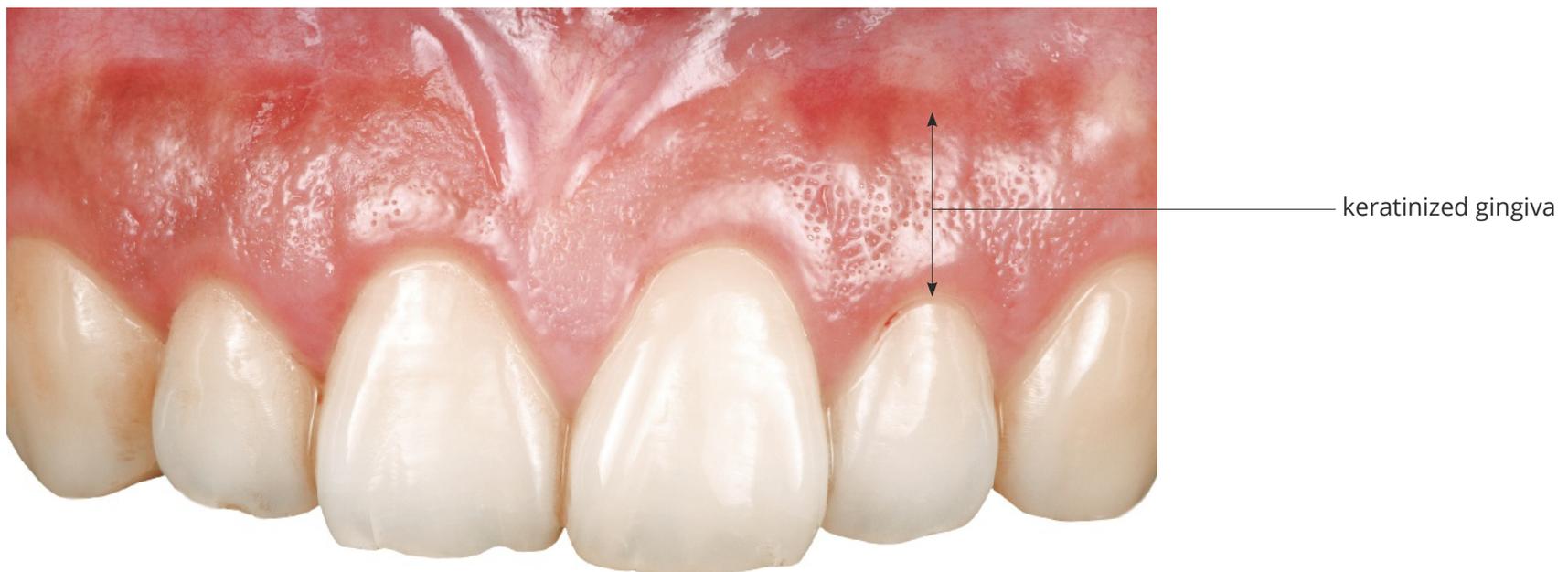


Fig 1-12 Labial view, keratinized gingiva of maxillary anterior teeth.

The nonkeratinized sulcular epithelium lines the gingival sulcus, extending from the coronal part of the junctional epithelium to the peak of the free gingiva. The junctional epithelium is also nonkeratinized stratified squamous epithelium, and is found from the bottom of the gingival sulcus to the CEJ, attached to the tooth surface by the basal lamina and hemidesmosomes. It maintains the oral epithelium lining on the tooth surface, ensuring continuity to protect the underlying alveolar bone from infection (Fig 1-13).

The thickness and turnover time of the oral epithelium vary in different regions. Data from animal experiments showed that the turnover time is 10 to 12 days for the oral epithelium, 5 to 6 days for the palate, tongue, and buccal mucosa, and 1 to 6 days for the junctional epithelium (Beagrie and Skougaard, 1962).

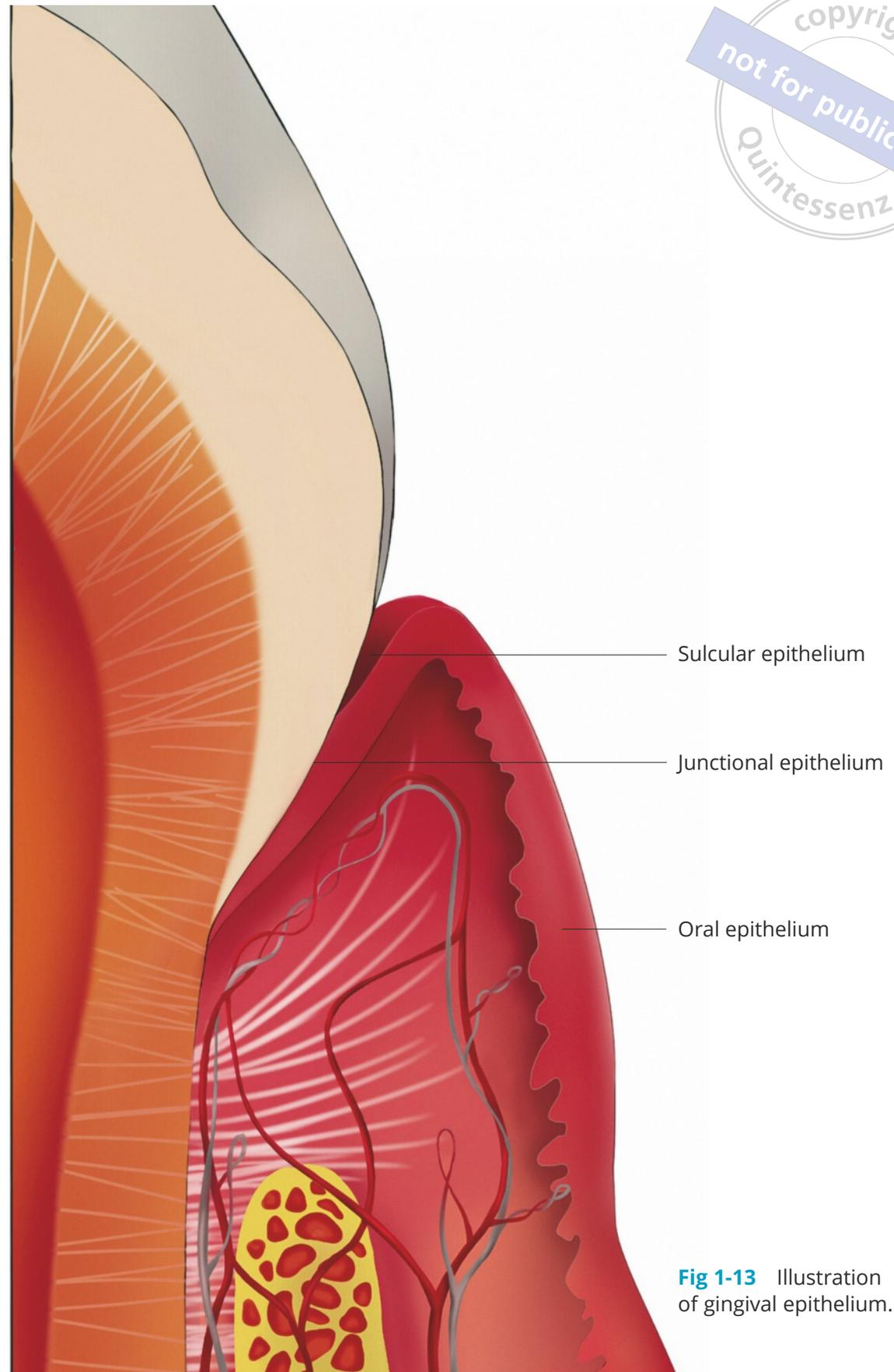
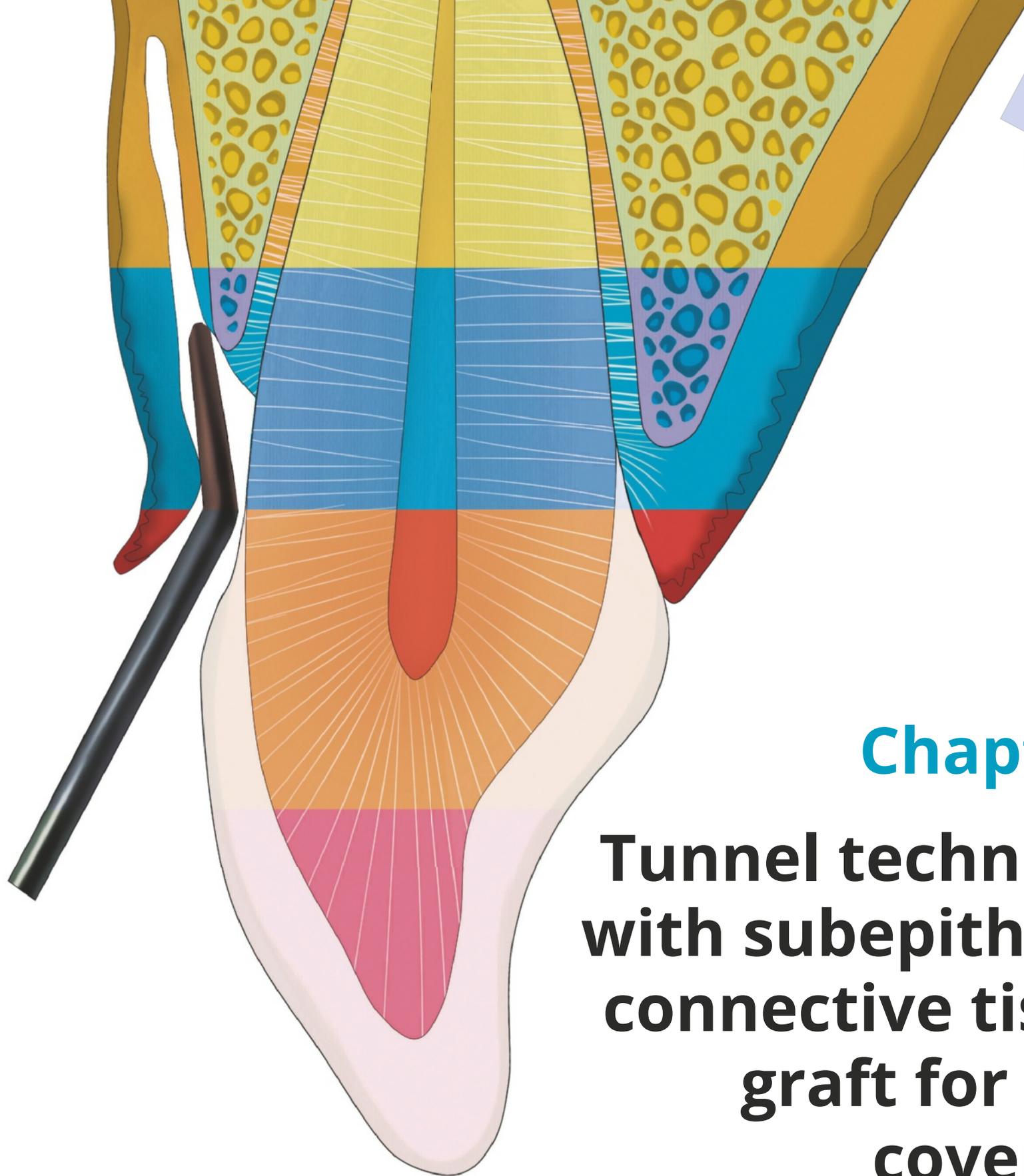


Fig 1-13 Illustration of gingival epithelium.



Chapter 7

Tunnel technique with subepithelial connective tissue graft for root coverage

For this combination technique, a partial-thickness flap with good mobility is separated by sharp dissection without severing the papillae, and coronally repositioned to cover the exposed root surface. Then the connective tissue harvested from the palate is inserted into the envelope under the flap. This surgical technique has the advantages of good blood supply, rapid healing, less trauma, high success rate, and no postoperative scar, although it requires a longer surgical time and is more technique-sensitive.



This method has become the first choice for treatment of gingival recession in the anterior esthetic region.





7.1 Indications

This method is indicated for Miller Class I and Class II recession defects on single or multiple teeth, and can achieve partial coverage for Class III recession.



Since vertical incision is avoided, the tunneling method alleviates the corresponding postoperative scar and thus achieves a more esthetic result. However, it also limits the extent of flap advancement; especially for single tooth recession, the coronal movement after separation of the partial-thickness flap is often limited compared with the classic coronally advanced flap. The tunneling method can obtain a good result for a slight recession (up to 3 mm) in the esthetic region. For cases with more than 3 mm recession, especially of a single tooth, due to the limitation of tension reduction the connective tissue graft (CTG) may not be completely covered; or during the healing process, the partial-thickness flap may have different degrees of recession, resulting in exposure of CTG. Exposure does not have a significant effect on the result of root coverage in cases with adequate flap coverage, but exposure of CTG can result in a mismatch in color and texture with the adjacent tissue, impairing the final esthetic outcome (Zucchelli and Mounssif, 2015).

A cross-sectional randomized controlled trial by Aroca et al (2013) showed that modified tunnel flaps with CTGs used for multi-tooth root coverage in Miller Class I or Class II patients achieved a 90% average root surface coverage 1 year after surgery, and 85% sites obtained complete root surface coverage. Also, the keratinized ridge width was increased by 2.7 mm on average compared with the preoperative situation.

Aroca S, Molnar B, Windisch P. Treatment of multiple adjacent Miller Class I and II gingival recessions with a modified coronally advanced tunnel (MCAT) technique and a collagen matrix or palatal connective tissue graft: a randomized, controlled clinical trial. *J Clin Periodontol* 2013;40:713-720.



7.2 Surgical procedure

1. Recipient site: After local anesthesia, the exposed root surface is planed with a curette, a turbine handpiece is used to properly contour and polish the excessively convex root surface, and the flowable composite resin is used to bond the contact area between the adjacent teeth. The incision runs along the gingival sulcus and the partial-thickness tunnel is sharply dissected underneath the epithelium across the mucogingival junction. The papilla area is dissected and a full-thickness flap is reflected. The tunnel must be able to move coronally 1 mm past the cementoenamel junction (CEJ) without tension after the preparation.
2. Donor site: a horizontal incision is made in the palate from the first premolar to the first molar. A partial-thickness flap is reflected under the epithelium, and the second incision separates the graft from the periosteum. Rectangular incisions are made around the connective tissue to detach it. The size of the connective tissue should exceed the coverage area, and the thickness is 1 to 2 mm. The excess adipose tissue and glands should be removed.
3. The leading suture is used to pull the connective tissue into the tunnel of the recipient site, not exceeding CEJ. The nonresorbable suture is used to make a double-crossed vertical sling suture to suspend the connective tissue and the papilla to the interproximal contact of the adjacent teeth.
4. After the surgery, the patient is instructed to use the mouthrinse for 2 weeks until the sutures are removed.

Even when the connective tissue could not be fully covered by the partial thickness flap, the connective tissue could still survive and achieve root coverage as there is enough overlap between the two parts. Some surgeons consciously expose a portion of connective tissue grafts in order to gain more keratinized gingiva. The disadvantage of doing this is that the exposed portion may have a significant difference in color from the surrounding tissue, thereby affecting the esthetic effect.

7.3 Clinical cases

7.3.1 Case 7-1 (Figs 7-1 to 7-34)



a



b

Figs 7-1a and b A 2-mm Miller Class I recession on the maxillary left first premolar.



Fig 7-2 The exposed root surface was planed and polished using a rubber cup and prophy paste.



Fig 7-3 The contact area between teeth was etched.



Fig 7-4 Binding adhesive was applied and air-dried gently.



Fig 7-5 Flowable composite resin was applied to the contact area.



Fig 7-6 Light curing the flowable composite resin.



Fig 7-7 The cured flowable composite resin can be used as an anchor for the sling suture.



Fig 7-8 Local anesthetic infiltration using 4% articaine.



Fig 7-9 Measurement of the gingival recession using a periodontal probe.



Fig 7-10 Separation of the partial-thickness flap from the sulcus with a bendable microblade.



Fig 7-11 Separation of the partial-thickness flap on the buccal side of the maxillary left first premolar, parallel to its long axis.



Fig 7-12 Separation of the partial-thickness flap on buccal aspect of the maxillary left canine.



Fig 7-13 Separation of the partial-thickness flap on the midbuccal aspect of the maxillary left second premolar.

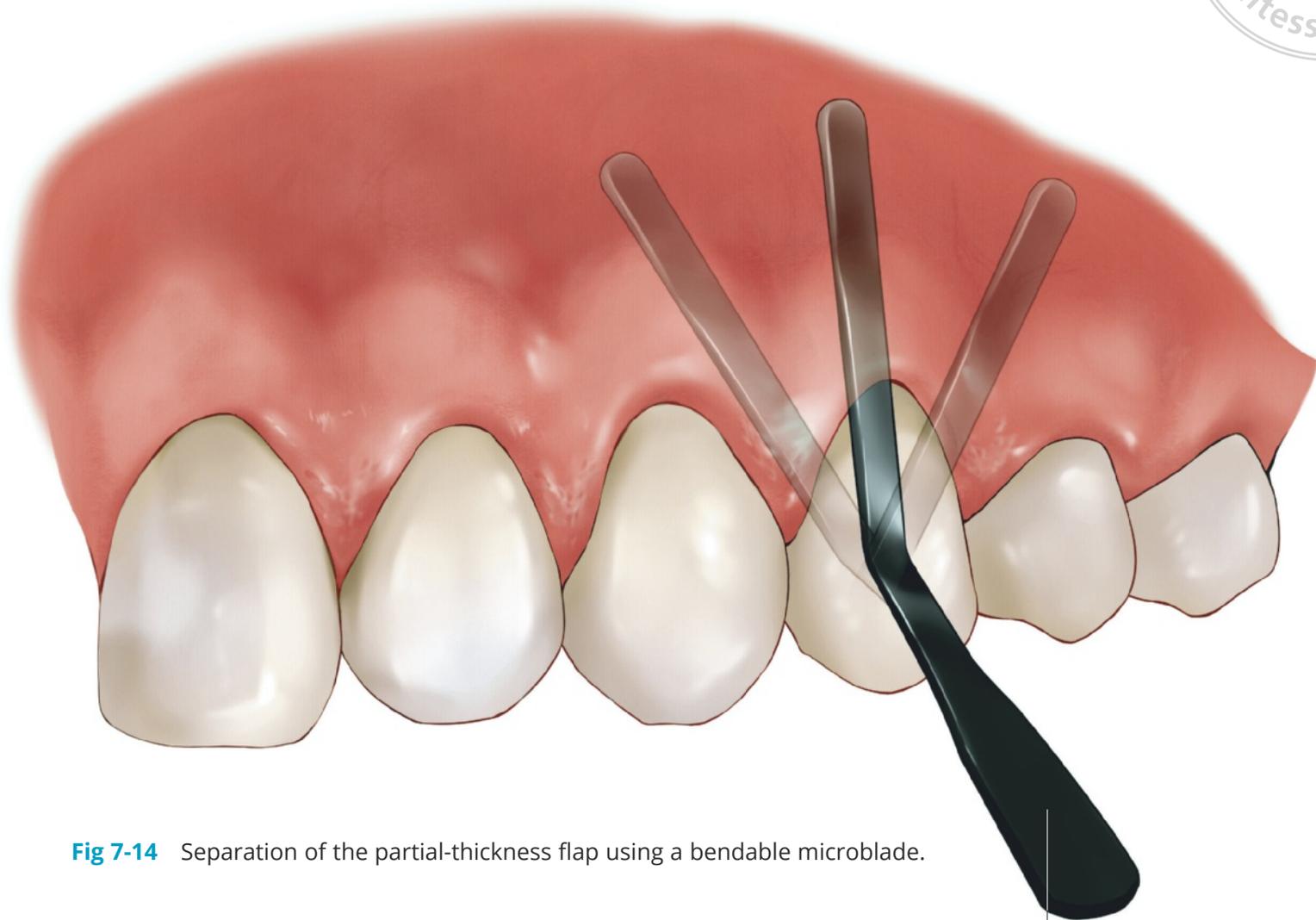


Fig 7-14 Separation of the partial-thickness flap using a bendable microblade.

The instrument should be parallel to the bone surface with care taken in the area of the mucogingival junction to prevent perforation

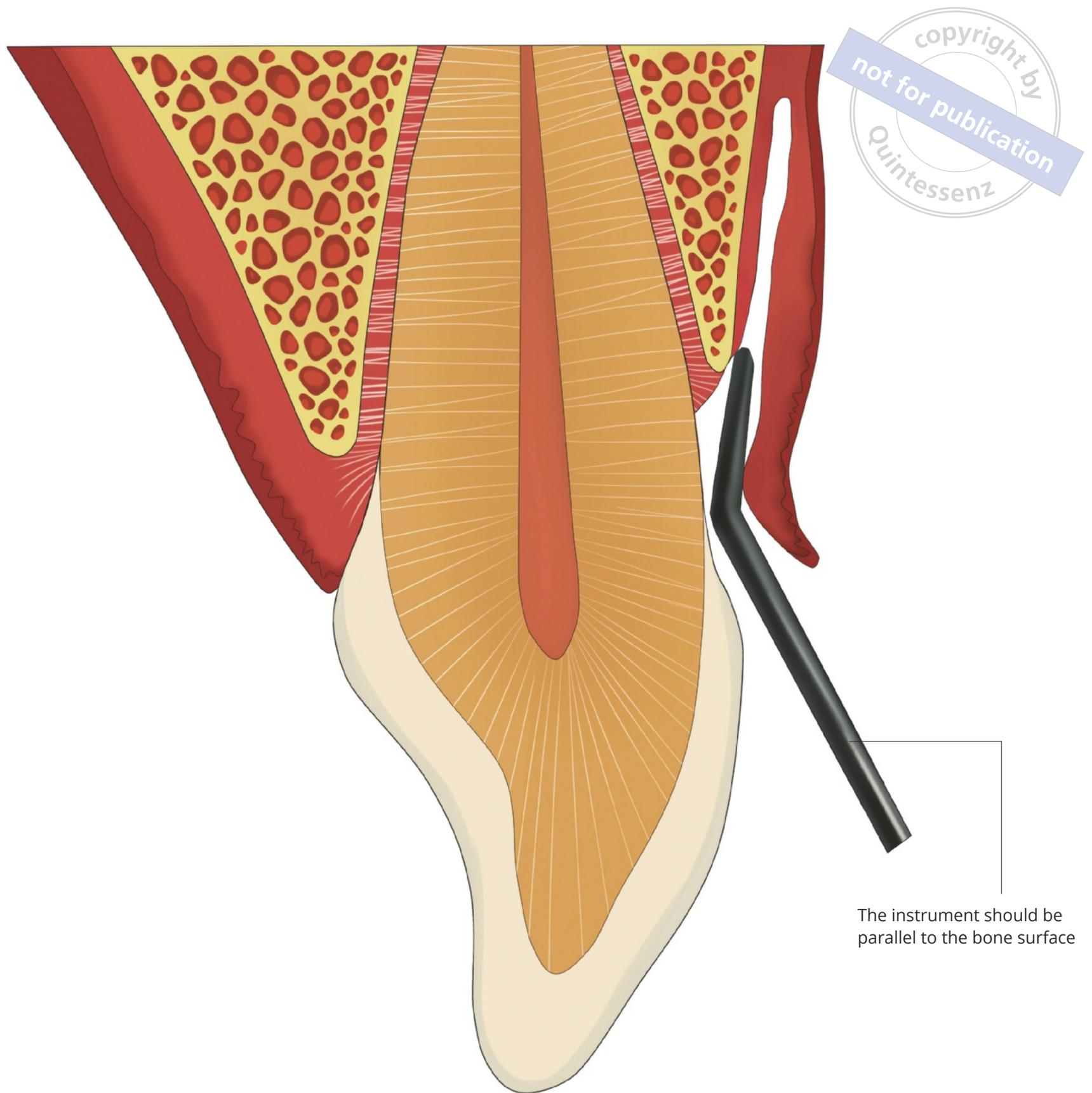


Fig 7-15 Separation of the partial-thickness flap using a bendable microblade (sagittal view).

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This well-illustrated atlas focuses on advanced surgical techniques for restoring soft tissue defects around natural teeth caused by varying degrees of gingival recession. Following a discussion of the biologic basis and rationale for increasing soft tissue volume, the authors review the development and mechanisms of root coverage. They provide step-by-step instructions for the prevailing techniques of root coverage therapy for a successful pink esthetic treatment outcome. Clinical cases demonstrate the techniques, outlining evidence-based principles and clinical considerations in a clear and easy-to-follow manner. For those who want to learn to predictably treat gingival recession, this book is an excellent aid.



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