Otto Zuhr Marc Hürzeler

Decision-Making at the Crossroads between Periodontology and Implant Dentistry

A Call for Personalized Oral Medicine

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Title of original issue: *Entscheidungsfindung im Spannungsfeld von Parodontologie und Implantattherapie – Zeit für personalisierte Oralmedizin*
Copyright © 2024 Quintessenz Verlags-GmbH, Berlin, Germany

A CIP record for this book is available from the British Library.
ISBN 978-1-78698-126-4

QUINTESSENCE PUBLISHING DEUTSCHLAND

Quintessenz Verlags-GmbH
Ifenpfad 2–4
12107 Berlin, Germany
www.quintessence-publishing.com

Quintessence Publishing Co Ltd
Grafton Road, New Malden
Surrey KT3 3AB, United Kingdom
www.quintessence-publishing.com

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Translation: Suzyon O'Neal Wandrey, Berlin, Germany
Illustrations: Angelika Kramer, Stuttgart, Germany
Layout, production, and reproduction:
Quintessenz Verlags-GmbH, Berlin, Germany

ISBN 978-1-78698-126-4
Printed in Croatia by GZH

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VOLUME 2

TECHNIQUES I

CHAPTER 10

SURGICAL TECHNIQUES FOR ACHIEVING HEALTHY AND STABLE GINGIVAL CONDITIONS

The decisive role of gingivitis as a precursor to periodontitis

It is important to mention that the presence of gingivitis is a precondition for the development of periodontitis. Successful treatment of gingivitis is thus the decisive step toward the prevention of periodontitis.[1,2] Gingivitis does not necessarily progress to periodontitis in every case.[3] However, evidence from long-term clinical studies has clearly shown that, if allowed to persist over a long period of a person's lifetime, gingivitis becomes a significant risk factor for the development of periodontitis and, ultimately, tooth loss.[4,5]

As already explained in detail in Chapter 5, this has a variety of clinical implications for the practicing dentist. If patients present at the dental office with the clinical picture of gingivitis, which still cannot be eliminated after they have received instruction in the use of suitable oral hygiene devices and regular prophylaxis appointments, consistent action is required. This includes, among other things, the elimination of iatrogenic obstacles such as marginal overcontoured fillings as well as the removal of natural biofilm accumulation sites such as surface irregularities on teeth. In severe cases, periodontal surgery is also required to reestablish conditions conducive to good oral hygiene (Fig 10-1).

Subgingival caries and tooth fractures are the primary causes of subgingival restorations, which are part of routine clinical practice. In prosthetic dentistry, clinicians often intentionally move restorative margins to a more apical position in the sulcus for functional or esthetic reasons. Restorative margins located within the sulcus do not cause gingivitis if the restorations have a good marginal seal and are designed so that they can be properly cleaned by patients as well as at regular dental hygiene visits.[6] However, if the margins are located more apically, in the area of the junctional epithelium (JE) or even the supracrestal fiber apparatus, apical shifting of the microbiologic contact zone will occur.[7] Although it remains unclear to this day whether the cause lies primarily in increased biofilm accumulation or in an immune response to the dental materials used,[8] *injury to the supracrestal tissue attachment* is expected to result in adaptation and adjustment processes in the epithelial and connective tissue attachment.[9] The reactions of the affected tissue can be divided into two different types: The first, a self-regulatory mechanism that works to reestablish adequate supracrestal tissue attachment, is accompanied by alveolar bone loss and the clinical picture of *gingival recession*. The second, *chronic gingivitis,* may develop in the absence of this self-regulatory mechanism of the body, with negative consequences for the long-term prognosis of the affected tooth.[10] In case of chronic gingivitis, there are two ways to enable the body to reestablish an intact supracrestal tissue attachment: surgical reduction of the alveolar bone to the appropriate level or, particularly in areas with esthetic relevance, orthodontic movement of the affected tooth and thereby of the restorative margin to a suitable distance away from the alveolar bone (see Chapter 12.4). Currently, there is no reliable evidence explaining the mechanism by which the body responds to the violation of the supracrestal tissue attachment in a given case, although alveolar bone thickness has been discussed as possibly playing a significant role. Contrary to scientific theory, clinical experience has shown that many patients tolerate restoration margins that appear to be located slightly apical to the floor of the sulcus.[11] This suggests that there is a certain range of tolerance to the inflammatory response, which may even vary from patient to patient (Fig 10-2).

Against this background, the decision to place a restorative margin subgingivally in cases where the clinician is free to choose the margin position must be viewed critically from a biologic point of view.[12] Therefore, restoration margins should be placed supragingivally or epigingivally whenever possible in order to prevent periodontal problems. If an intrasulcular margin is to be used in a given case, the only way to ensure that the preparation margin is located coronal to the sulcus floor is to estimate the vertical dimension of the supracrestal tissue attachment available in that specific case. This dimension can be determined radiographically as well as by probing the clinical sulcus or by sounding the dentogingival complex.[13,14] The safest approach, however, appears to be not extending the preparation margin more than 0.2 to 0.5 mm into the sulcus.[11] Because the sulcus is slightly deeper interproximally, it is possible to prepare a little further into the sulcus in this area if necessary.[15] Should the preparation margin be placed any deeper, the importance of gently placing a thin retraction cord in the coronal part of the JE prior to preparation cannot be emphasized strongly enough.[16] In this way, preparation beyond the sulcus floor is prevented, and the risk of biologic complications can at least be minimized (Fig 10-3).

Resective periodontal surgery is indicated for the management of subgingival restoration margins causing chronic gingivitis in areas where esthetics is not a

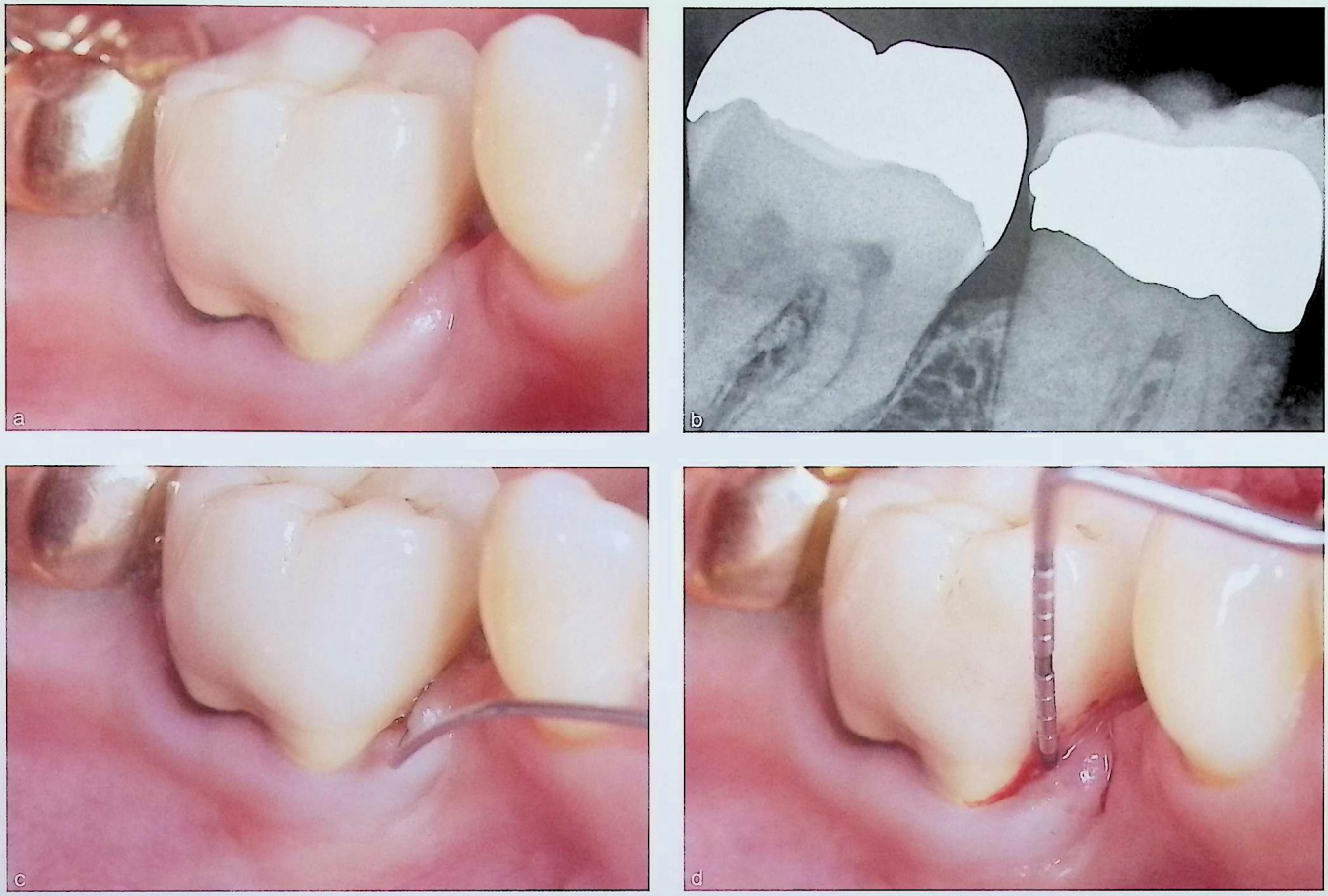


Fig 10-1a to d If allowed to persist over a long period of a person's lifetime, gingivitis becomes a significant risk factor for the development of periodontitis and, ultimately, tooth loss. In severe cases, periodontal surgery is required to reestablish conditions conducive to good oral hygiene and, as in this case, to remove the deep subgingival restoration margins.



Fig 10-2a and b If a subgingival restoration margin results in violation of the supracrestal tissue attachment, this may trigger a self-regulatory mechanism associated with alveolar bone loss and gingival recession (a), or chronic gingivitis may occur (b).

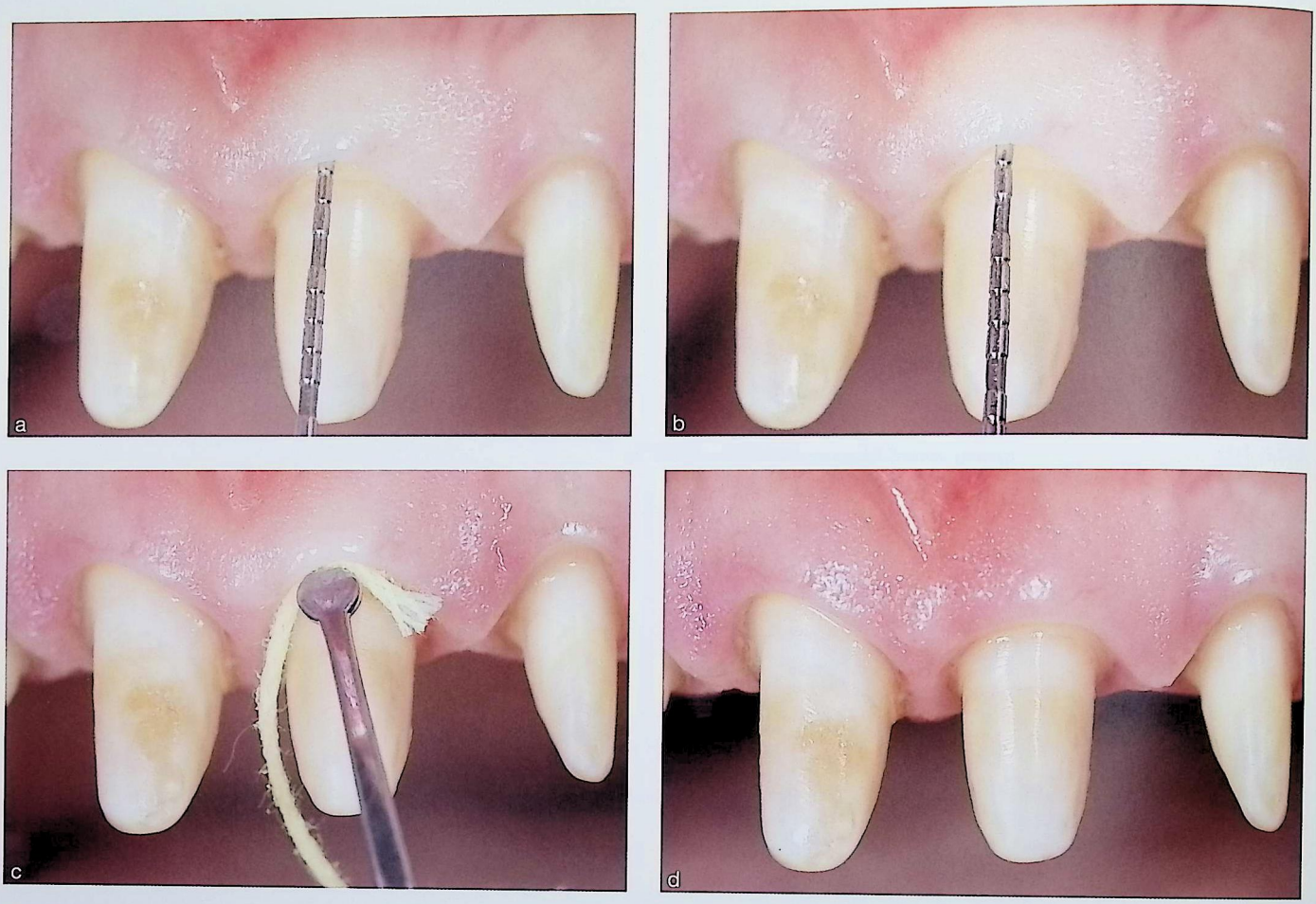


Fig 10-3a to d In situations where the clinician is free to choose the margin position, the decision to place restorative margins subgingivally must be critically scrutinized from a biologic point of view. If, nevertheless, an intrasulcular margin is to be used in a given case, the safest way to prevent violation of the supracrestal tissue attachment is to ensure that the preparation margin does not extend more than 0.2 to 0.5 mm into the gingival sulcus. Should it be necessary to place the margin deeper into the sulcus, the actual vertical dimension of the supracrestal tissue attachment can be estimated by probing the clinical sulcus (a) or sounding the total dentogingival complex dimension (b). The insertion of a thin retraction cord into the coronal part of the junctional epithelium (JE) before preparation (c) appears to be the most reliable way to protect the structures lying apical to it from injury during preparation (d).

concern. Frequently, it is also indicated for functional reasons, for example, to achieve sufficient ferrule in endodontically treated and post-and-core-restored teeth to avoid subgingival restoration margins. Last but not least, resective surgery is an indispensable tool in many cases of restorative treatments when subgingival restoration margins are present, to prevent periodontal problems and facilitate accurate and error-free work.

Gingival recession leads to the loss of periodontal attachment

In view of the goal of preventing further loss of periodontal attachment, periodontal surgery is generally indicated for the treatment of gingival recession in areas without esthetic relevance only in cases when periodontal health cannot be reestablished or when gingival recession becomes progressive over time (see Chapter 8). While the esthetic outcome is a primary concern when treating recession defects in areas with esthetic relevance, the biologic–functional outcome is the main consideration when treating recession defects in areas where esthetics is not a concern.[17] As extensively explained in Chapter 8, it is crucial in this context to achieve a sufficiently wide and thick gingiva for optimal hygiene capability and the best possible long-term prognosis. In light of this, as an alternative to coronally advanced flaps with connective tissue graft (CTG) – the current "gold standard" for root coverage – excellent long-term results can also be achieved in such cases with a "free gingival graft" (FGG) from the hard palate.[18–22] Although the use of these grafts typically results in soft tissue with more keratinization, gingival thickness, and gingival width than would be acceptable in esthetically relevant areas, the reconstructed tissue is stable, mechanically resilient, and, in this way, easier for patients to clean. It proves advantageous in this regard that, in contrast to the tendency for recurrence after the established techniques for covering gingival recessions, long-term studies following the use of FGGs have shown an opposite trend over the years, with a progressive coronal development of the gingival margin and a consequently increasing coverage of the previously exposed root surfaces, along with a simultaneous narrowing of the gingiva.[18,22] Another aspect to consider is that most of the research reports of successes achieved using coronally advanced flaps pertain to recession coverage in the maxilla. Although the percentage of attained root coverage seems to be inferior in direct comparison,[23–25] there are often strong arguments in favor of the alternative use of FGGs in the mandible, where the anatomical characteristics (eg, a shallow vestibule, high muscle attachment, high labial frenum attachment, or extremely narrow and paper-thin gingival tissue) are often unfavorable for the success of conventional flap procedures.[26] Even if their use may seem somewhat "old-fashioned," FGGs adapted to the current state of scientific knowledge can even, in the context of modern dentistry, serve as an excellent alternative in areas without esthetic relevance, in agreement with patients, when the goal of treatment is to reestablish conditions conducive to good oral hygiene and marginal gingiva stability, especially in the treatment of localized gingival recessions or few adjacent recessions in the mandibular and maxillary posterior or also mandibular anterior regions (Fig 10-4).

Based on clinical experience, treatment outcomes similar to those following the use of FGGs, with thick, wide, and possibly even hyperkeratinized gingiva, can be expected when coronal advanced flap procedures are performed for the treatment of gingival recessions, and small portions of the deepithelialized FGGs positioned on the avascular root surface are intentionally left uncovered. The results achieved with this strategy often resemble the esthetically compromised outcomes obtained after treatment with FGGs, or CTGs that are intentionally only partially covered and with the exposed part not being deepithelialized with the purpose of increasing the gingival width[27–29] (see Chapters 7 and 8). As previously explained, the esthetic disadvantages in these cases can, however, be reversed, when gingival recession in areas without esthetic relevance is treated primarily with the aim of reestablishing conditions conducive to good oral hygiene and marginal gingiva stability.

In terms of postoperative pain, FGGs are only limitedly suitable for the treatment of multiple gingival recessions because large wounds are created both on the hard palate and in the recipient area, which mostly require secondary wound healing. If, for this reason, qualitative esthetic success criteria in consultation with the patient do not play a role, coronally advanced flaps with partially exposed deepithelialized FGGs can be an excellent alternative to FGGs for the treatment of multiple gingival recessions, especially in the mandibular anterior region. Tunneling flap procedures appear to offer great advantages in this indication, particularly in cases of thin and narrow gingival conditions as well as small-sized papillary surfaces[30] (Fig 10-5).

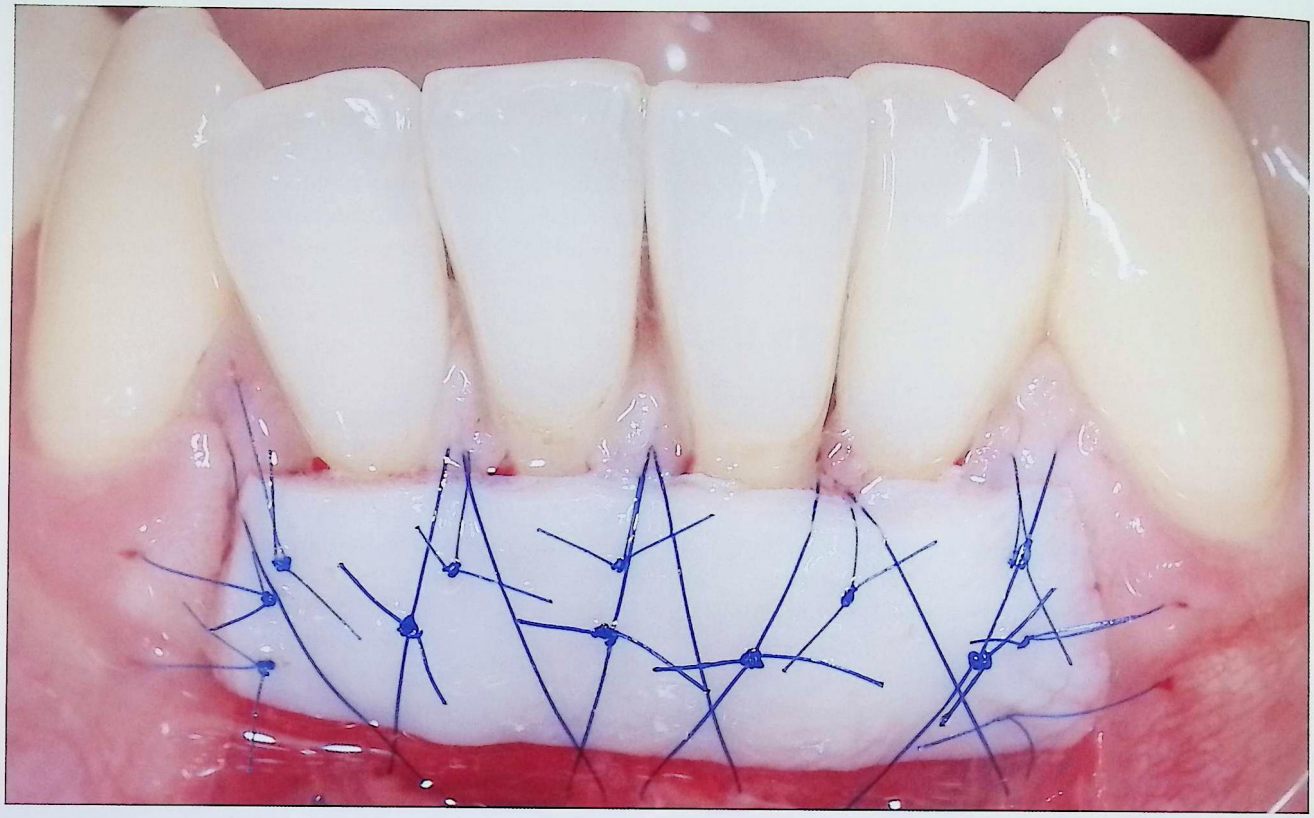


Fig 10-4 Free gingival grafts (FGGs) can be an excellent alternative to conventional techniques for the treatment of localized gingival recessions or a small number of multiple adjacent recessions and for reestablishing conditions conducive to good oral hygiene and marginal gingiva stability in areas without esthetic relevance.

About the techniques described below

For the techniques described below, the execution of apically repositioned flaps to eliminate deep subgingival restoration margins was selected as an example to illustrate the topic of "resective periodontal surgery for establishing healthy gingival conditions." Under the topic '"mucogingival surgery for establishing gingival stability," the chosen examples are the use of FGGs for the treatment of progressive localized gingival recessions as well as the tunnel technique combined with a deepithelialized FGG for the treatment of progressive multiple gingival recessions in areas without esthetic relevance.



Fig 10-5a to c Coronally advanced flaps with partially exposed deepithelialized FGGs can be an excellent alternative to FGGs for the treatment of multiple gingival recessions in areas without esthetic relevance. Tunneling flap procedures appear to offer great advantages when used in cases where the gingiva is thin and narrow as well as in situations with small-sized papillary surfaces, particularly in the mandibular anterior region.

10.1 Resective Periodontal Surgery for Establishing Healthy Gingival Conditions

Resective periodontal surgical procedures for the elimination of subgingival restoration margins are often performed in the scope of restorative treatments and are designed to prevent further periodontal problems and enable accurate and error-free work. They are also indicated in cases where chronic gingivitis caused by subgingival restoration margins persists despite good oral hygiene by patients. If periodontal surgery is to result in predictable apical repositioning of the gingival margin, then the supracrestal tissue attachment is a constant dimension that must be taken into account. Whenever supracrestal soft tissue is completely or partially removed during the course of external gingivectomy or is moved to a more apical position in the context of apically repositioned flap surgery, regrowth of the lost epithelial and connective tissue attachment always occurs during the postoperative healing period – in order to maintain the microbiologic and mechanical protective function of the gingiva for the underlying anatomical structures – resulting in regeneration of the dentogingival complex (see Chapter 2). Thus, after completion of the healing in these cases, buccal and lingual soft tissue with a height of approximately 3 mm and interproximal sites of approximately 4 mm above bone level can be expected.[15,31,32] Because the supracrestal tissue attachment may be reestablished by either coronal growth of the gingiva or apical development of the soft tissue in conjunction with marginal alveolar bone resorption, or a combination of these two processes, it is difficult to predict the final position of the gingival margin. Therefore, the key to successful and predictable surgical crown lengthening is to carefully adapt the technique to the specific anatomical conditions present at baseline (Fig 10-6).

In a prospective clinical study relevant to this context, Pontoriero et al performed preprosthetic surgical crown lengthening in 30 periodontally healthy patients.[32] After mucosal flap elevation, the bone course was modeled according to the later restoration margins, the supracrestal fiber apparatus was thoroughly removed from the root surfaces, and the flaps were immobilized at bone level using periosteal sutures. Twelve months postoperatively, they observed vertical soft tissue regeneration amounting to a mean postsurgical soft tissue regrowth of 3.2 and 2.9 mm at interproximal and buccal sites, respectively. The extent of coronal growth of the gingival margin was statistically significantly higher in patients with thick gingival phenotypes than in those with normal or thin gingival phenotypes.[32] These results were confirmed by other clinical studies[34,35] (Fig 10-7).

The reference values established in this manner can be very useful for implementing predictable and at the same time minimally invasive resective periodontal surgical procedures for the elimination of subgingival restoration margins. Clinical experience has shown that if the marginal alveolar bone height is contoured to a level of approximately 3 mm from the planned gingival margin, the intended crown lengthening can be predictably achieved. However, this applies only if thorough intraoperative removal of residual periodontal fibers inserting into the root cementum from the root surface down to the level of the bone is performed. Based on the results of animal and clinical studies, it can be assumed that the reestablishment of the supracrestal tissue attachment takes place partly in the apical direction in this manner, in conjunction with resorption of the most marginal parts of the alveolar bone.[34,36–38] Apparently, this prevents postoperative coronal migration of the soft tissue margin beyond the planned level to a certain degree (Fig 10-8).

The main differences between apically repositioned flap techniques used in the surgical treatment of periodontitis versus those used in restorative dentistry for the elimination or prevention of subgingival restoration margins lie in the *contouring of alveolar bone* and the handling of *periodontal fibers* inserting into the root cementum coronal to the bone. In particular, the "fiber retention" technique aims to reduce osteoplasty and ostectomy to the absolutely necessary minimum and to achieve the goals of periodontal pocket elimination and simultaneous best possible clinical attachment gain by making every effort to preserve intact, undamaged periodontal fibers still present coronal to the alveolar bone and in the area of the bony defect. Conversely, apically repositioned flap procedures for the elimination of subgingival restoration margins always include alveolar bone contouring to the extent needed to create the desired gingival margin contour and the thorough removal of periodontal fibers inserting into the root cementum coronal to the contoured bone. All other aspects of surgery relating to incision design, flap preparation, flap mobilization, and flap stabilization on the buccal and oral aspects of the maxilla and mandible, including possibly

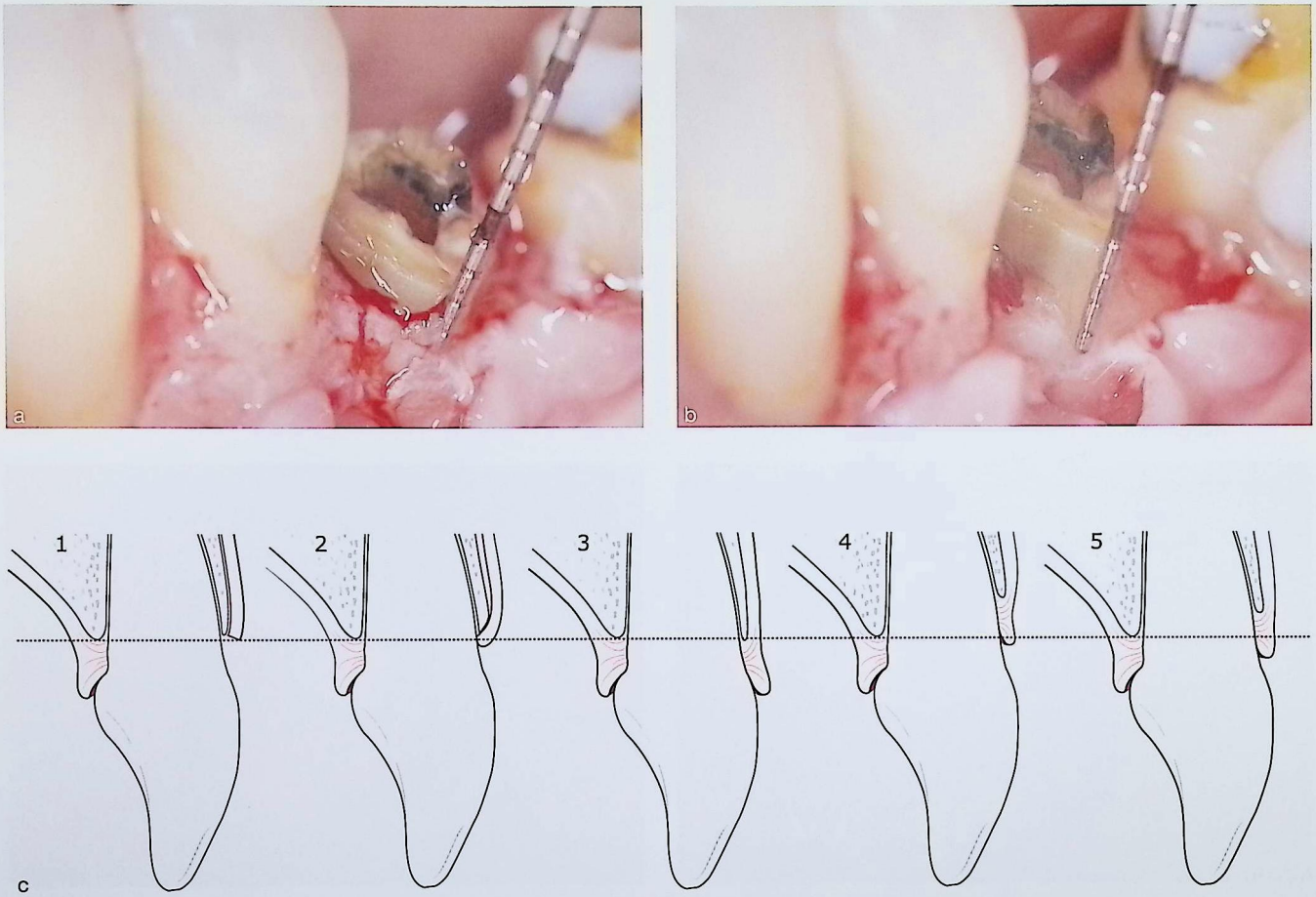
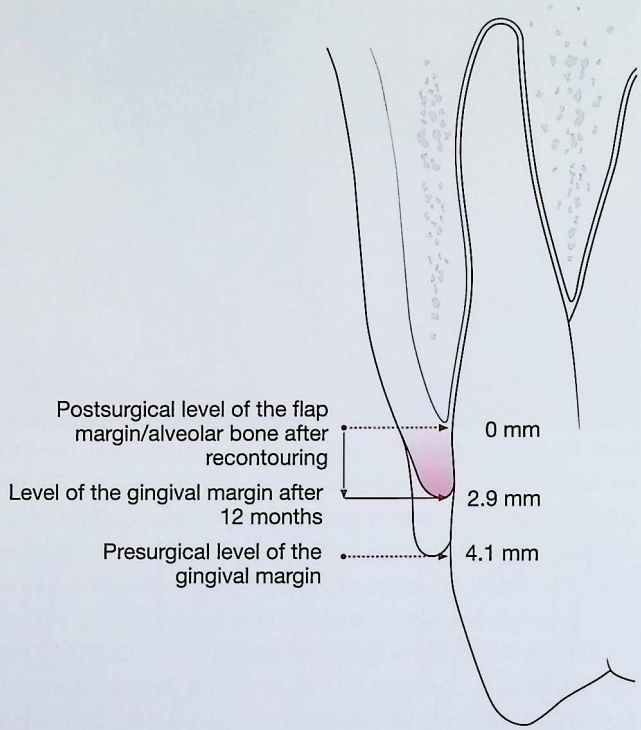
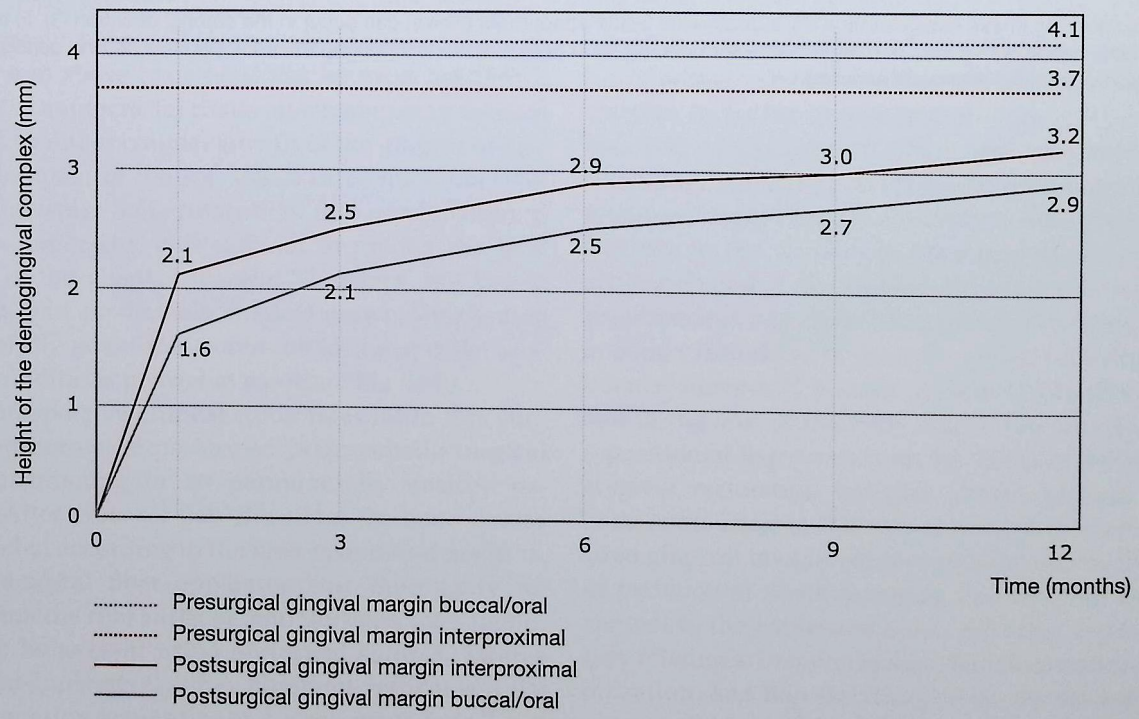


Fig 10-6a to c Whenever supracrestal soft tissue is removed during the course of external gingivectomy (1) or apically repositioned during flap surgery, as in this case example (2), supracrestal tissue attachment growth can occur in the coronal direction (3), in the apical direction in association with a loss of marginal alveolar bone (4), or in both directions (5) during the postoperative healing period, depending on the type of surgical approach adopted.



a

Fig 10-7a and b Twelve months after surgical crown lengthening with complete removal of the supracrestal fiber apparatus from the affected root surfaces, vertical soft tissue regeneration amounting to a mean postsurgical soft tissue regrowth of 3.2 and 2.9 mm at interproximal and buccal sites, respectively, can be expected.[32]



b

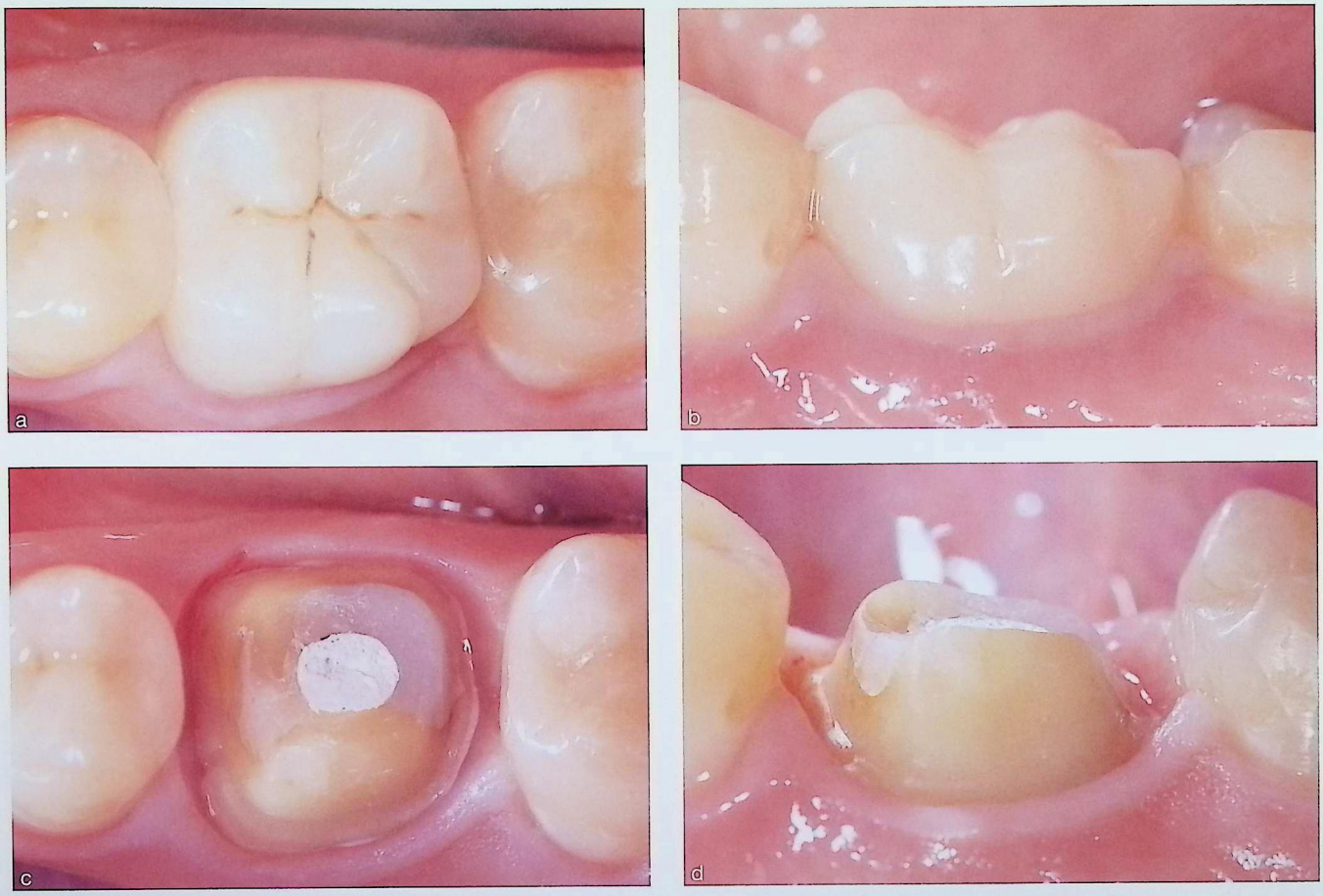


Fig 10-8a to d Clinical case example in which a deep subgingival margin on the mesial aspect of tooth 36 is eliminated by resective periodontal surgery in the scope of a prosthetic restoration. Fig 10-8a to d show the tooth with and without a long-term temporary before surgery.





Video 10-1 Osseous resection in conjunction with apically repositioned flaps for the elimination of subgingival restoration margins in the case example described above.

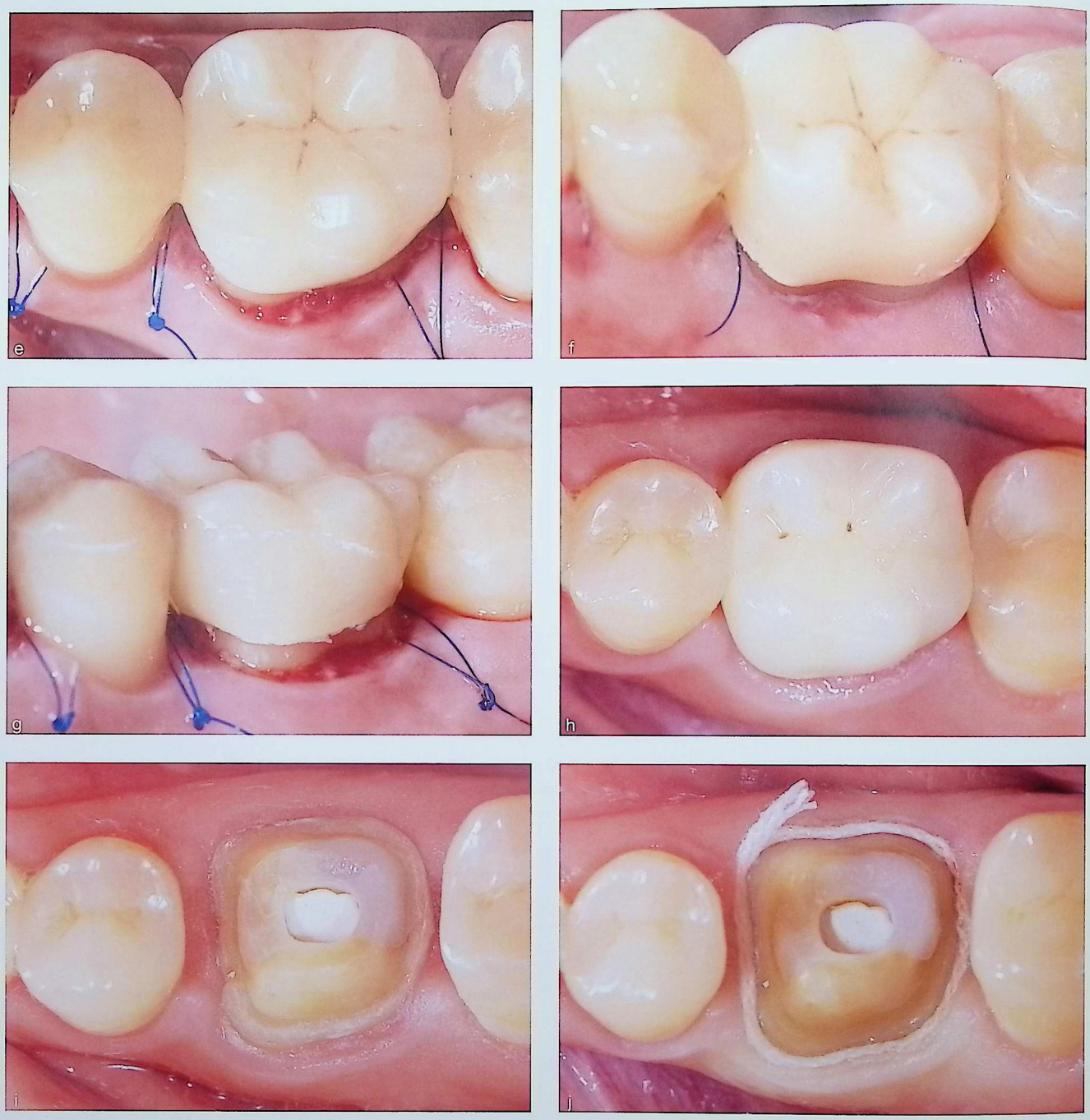


Fig 10-8e to m The situation immediately before suture removal, 1 week after the apically repositioned flap procedure. The distance between the flap margin and the preparation margin is approximately 2 mm at this time (e to g). Six-month postoperative healing outcome, highlighting the almost exactly epigingival position of the restoration margin. Intraoperative bone contouring to adjust the marginal alveolar bone height to a level approximately 3 mm from the planned gingival margin and thorough removal of the residual periodontal fibers inserting into the root cementum from the root surface to the bone enable the predictable establishment of the desired gingival margin (h and i). Because of the epigingival location of the restoration margin, finalization of the prosthetic work can be carried out in a simple and precise manner (j and k). After the completion of treatment, the periodontium is in a healthy and easy-to-clean state (l and m).







required distal wedge excisions, are completely analogous to the methods described in detail in Chapter 11 on resective surgical treatment of periodontitis. A detailed explanation of the surgical procedure for apically repositioned flaps will therefore not be provided here, and reference will be made to Chapter 11 for more detailed information about the techniques mentioned below (Fig 10-9).

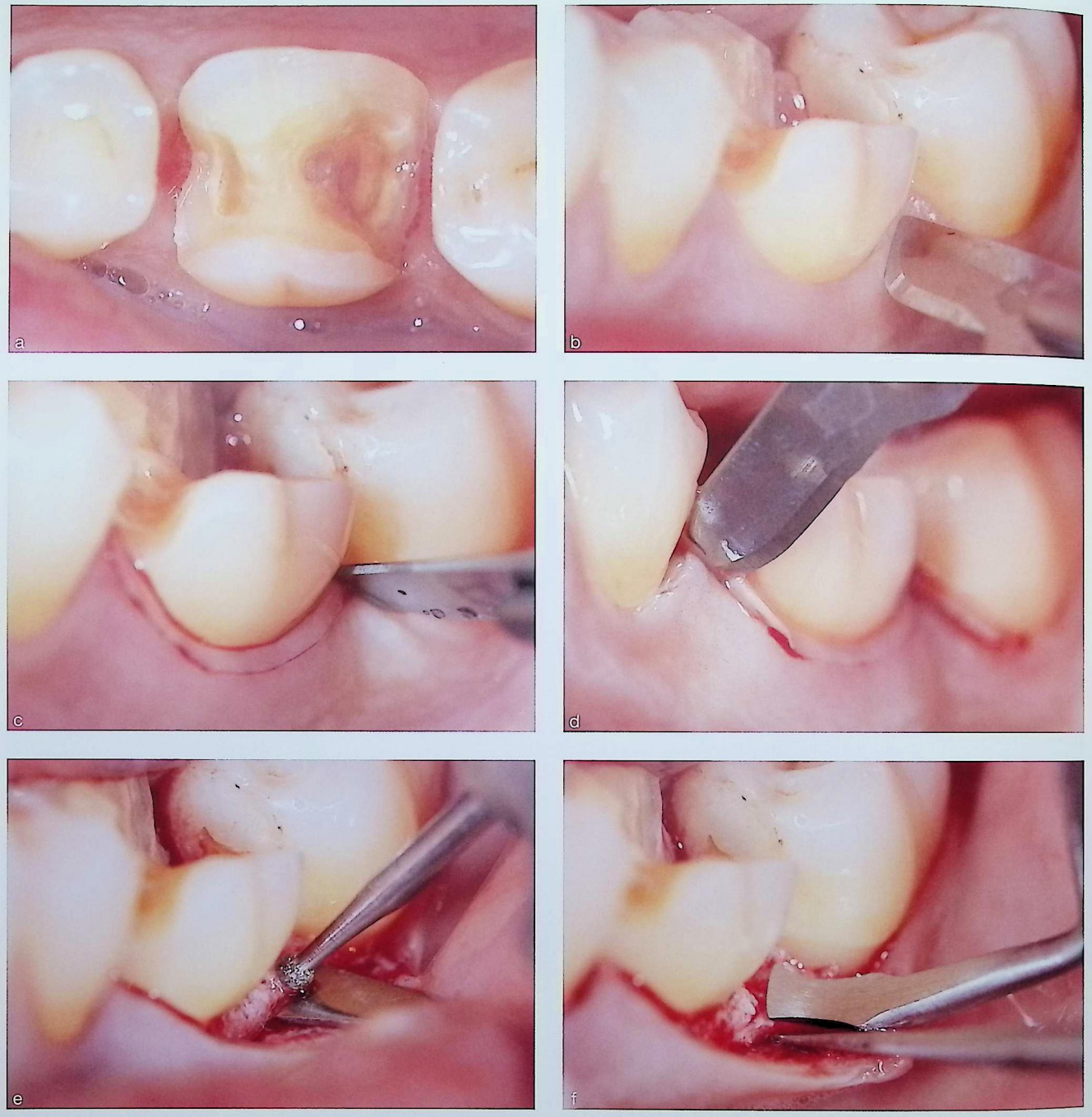
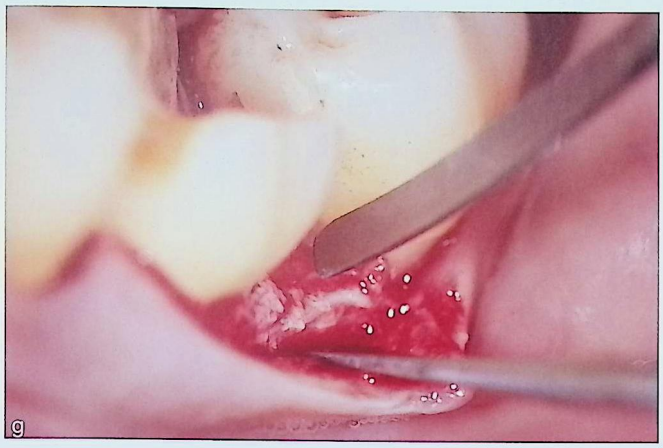
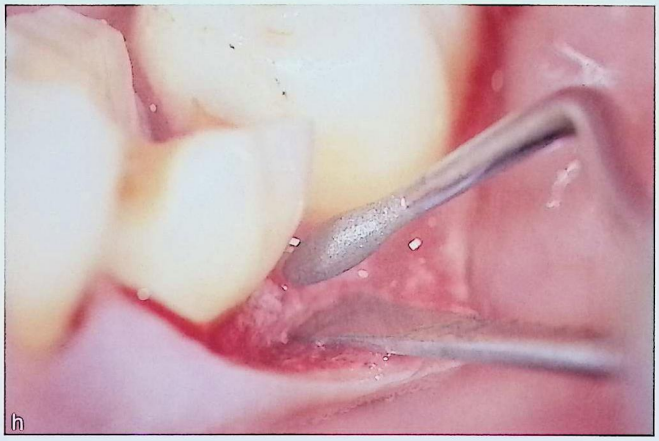
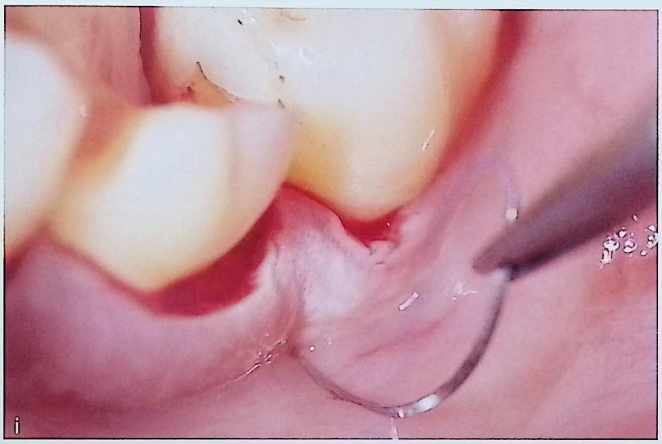
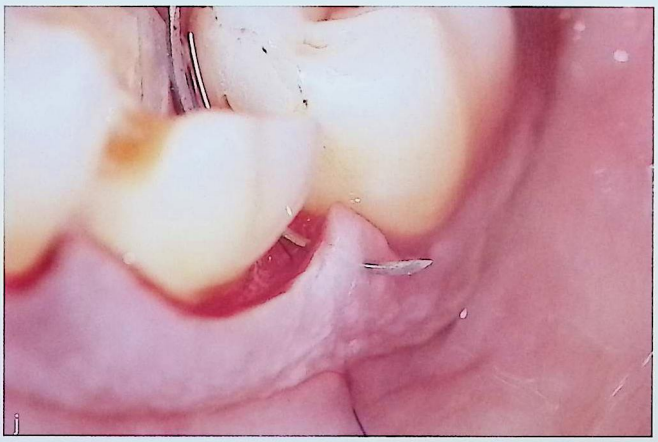


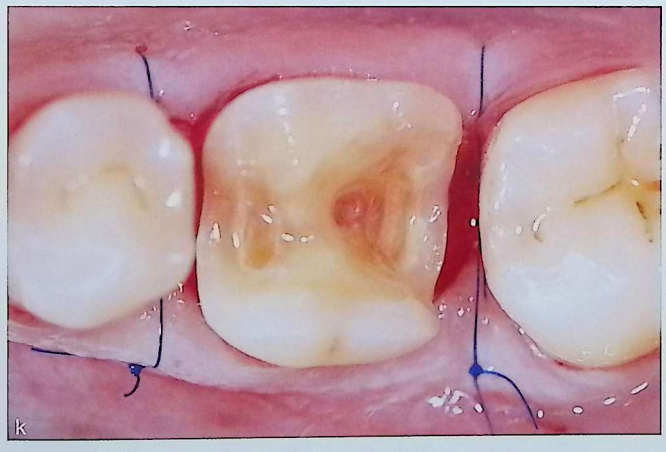
Fig 10-9a to l Apically repositioned flap-based strategies for the treatment of periodontitis versus the elimination of subgingival restoration margins are analogous with respect to incision design, flap preparation, flap mobilization, and flap stabilization but differ in terms of the inclusion or avoidance of alveolar bone contouring and periodontal fiber removal. In the latter case, bone contouring is always performed to the extent needed to achieve the desired gingival margin contour (e to g), and the periodontal fibers inserting into the root cementum coronal to the bone are completely removed (h).

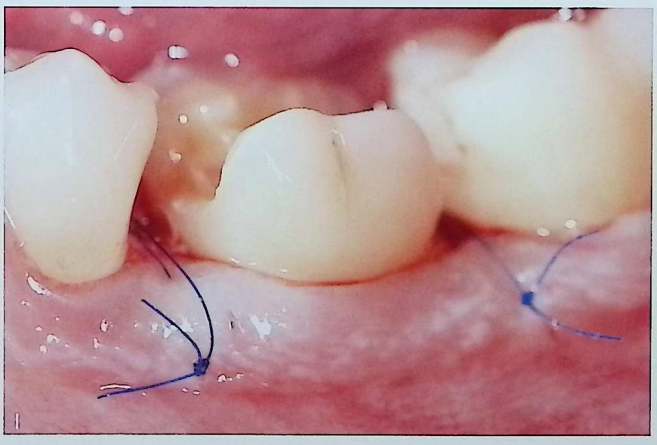

g


h


i


j


k


l

10.1.1 Apically repositioned flap to establish hygiene-conducive conditions prior to restorative therapy in the maxilla

CASE PRESENTATION

Clinical history

General medical history

- 67-year-old male
- Married, one child
- Retired school teacher
- No known general medical conditions, no relevant medication intake

Special anamnesis

- Despite good oral hygiene, localized gingivitis with bleeding on probing (BOP) at the two molars restored with crowns in the maxillary left quadrant
- Inadequate restorations on both maxillary left molars, with deep subgingival crown margins and advanced secondary caries
- Apical periodontitis due to incomplete root fillings in both maxillary left molars

Main concern

"My upper left gums are constantly inflamed."

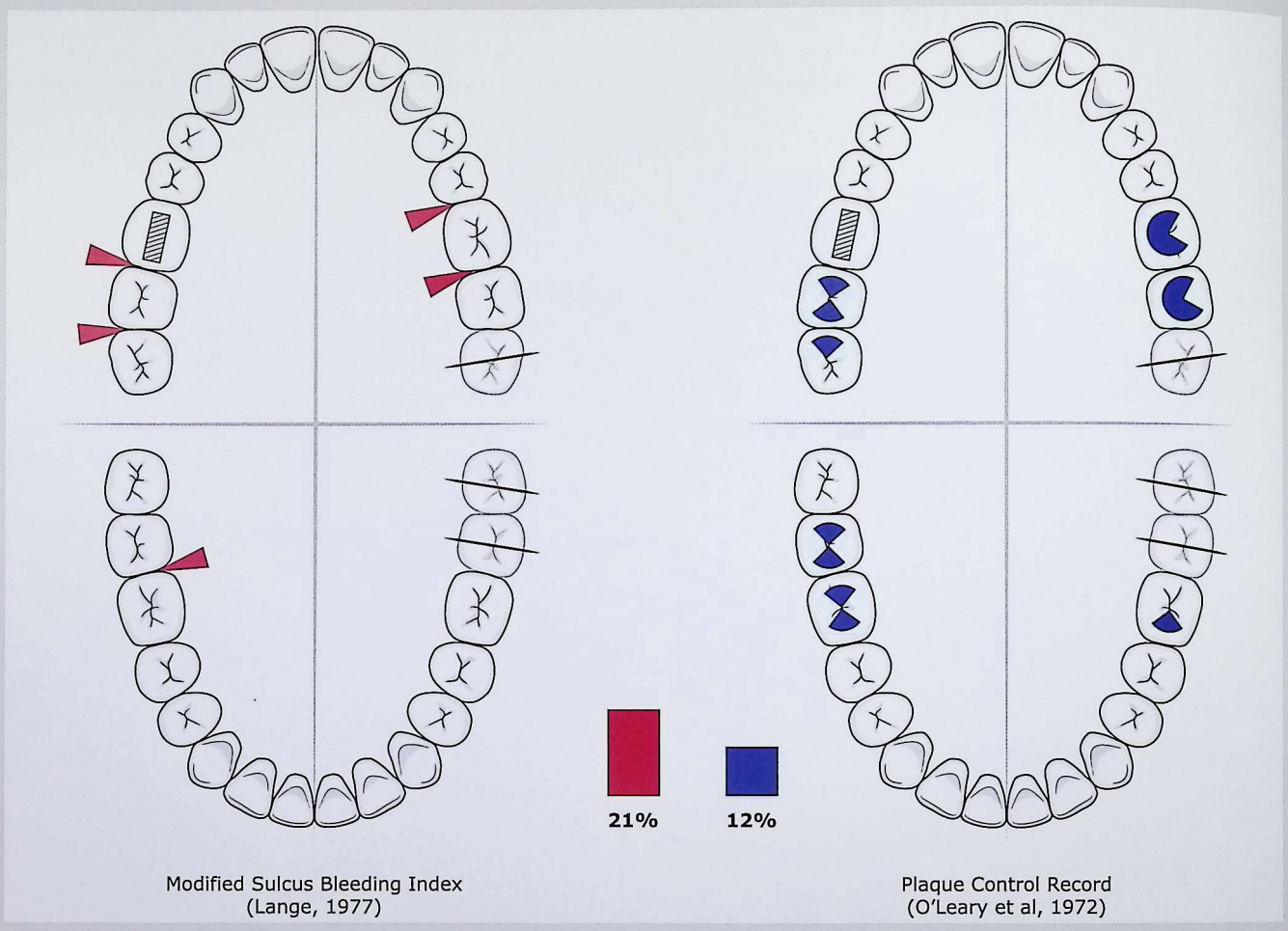
Initial situation after crown removal, caries treatment, endodontic revision, and long-term temporization

Intraoral findings





Oral hygiene findings



Modified Sulcus Bleeding Index
(Lange, 1977)

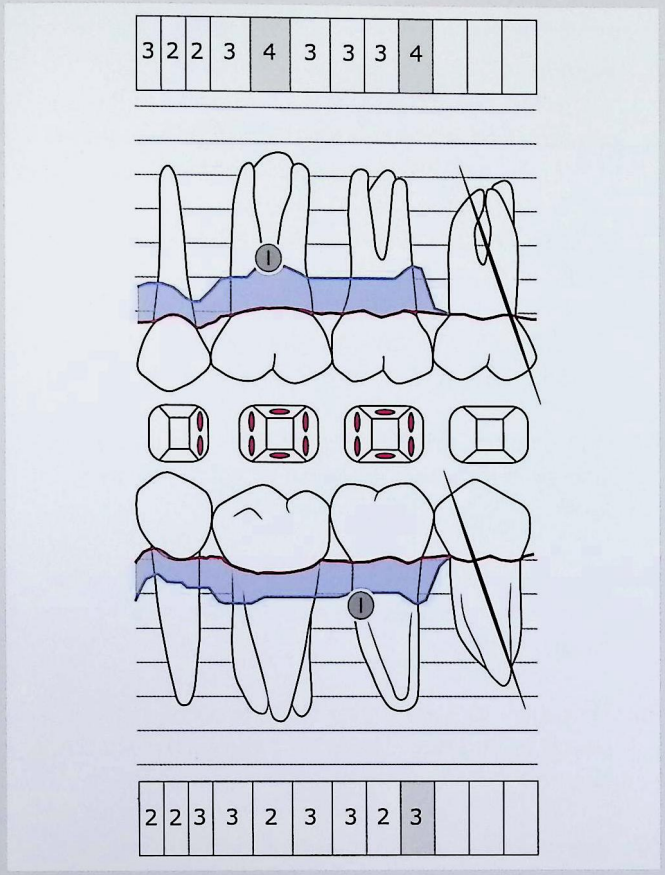
Plaque Control Record
(O'Leary et al, 1972)

Radiographic findings





Periodontal findings



Diagnosis

- Localized gingivitis at teeth 26 and 27
- Deep subgingival crown margins at teeth 26 and 27

Clinical decision-making – rationale for choosing the technique described in this case

- The teeth to be treated are located in an area without esthetic relevance
- The apically repositioned flap procedure is a reliable and predictable method of reestablishing good oral hygiene and periodontal health
- Because of the partially minimal distances between the restoration margins and the surrounding bone of the teeth, the marginal alveolar bone must be contoured in order to achieve epigingival or supragingival margin placement

Prognosis

+ Medically healthy patient, good oral hygiene, nonsmoker
+ Area without esthetic relevance
– Severely decayed, endodontically treated teeth with little remaining tooth structure
– Removal of intact periodontal tissue is inevitable
– Relatively coronally located furcation entrances
– Demanding surgical procedure
– Magnification aids and microsurgical instruments are required

KEY POINTS IN BRIEF

01. Decision-making regarding the exact surgical procedure mainly on the basis of the height of the dentogingival complex, determined by *sounding,* as well as the distance between the restoration margins and the marginal alveolar bone, taking into account the *periodontal* and *radiographic examination findings*

02. *Incision design:*
Intrasulcular incision:
- Along the *buccal* aspect of the affected teeth, *without cutting the periosteum*

Paramarginal incision:
- Along the *palatal aspect* of the affected teeth. The *distance from the gingival margin* is determined by the *height of the palatal vault* and the *anticipated bone margin* after intraoperative bone contouring. Attention must be paid to the *perpendicular* alignment of the scalpel blade to the surface of the palatal masticatory mucosa

Surface incisions for the "distal wedge" procedure:
- *Distal to the terminal molar,* on the *buccal* and *palatal side.* Attention must be paid to the *perpendicular* alignment of the scalpel blade to the soft tissue surface

Interdental incisions for development of the surgical papillae:
- From *buccal* and *palatal, perpendicular* to the surface, *as far into the interdental space* as technically feasible

03. *Mucosal flap preparation:*
Buccal:
- Parallel to the soft tissue surface and extended apically, mesially, and distally as far as necessary to allow flap displacement to the desired apical position *without tension*

Palatal:
- In the coronal part: initially *parallel* to the surface of the palatal masticatory mucosa and, finally, at the base of the flap, *extended to the bone.* On the mesial aspect, a second internal *vertical incision* is extended to the bone

Distal to the terminal molar:
- On the *buccal* and *palatal aspects, initially parallel* to the mucosal surface and, finally, at the base of the flap, *extended to the bone*

04. Removal of the *tissue wedge* created by the incision on the *palatal side* and *distal to the terminal tooth*

05. Bone contouring to adjust the marginal alveolar bone height to a level *3 mm* from the planned gingival margin

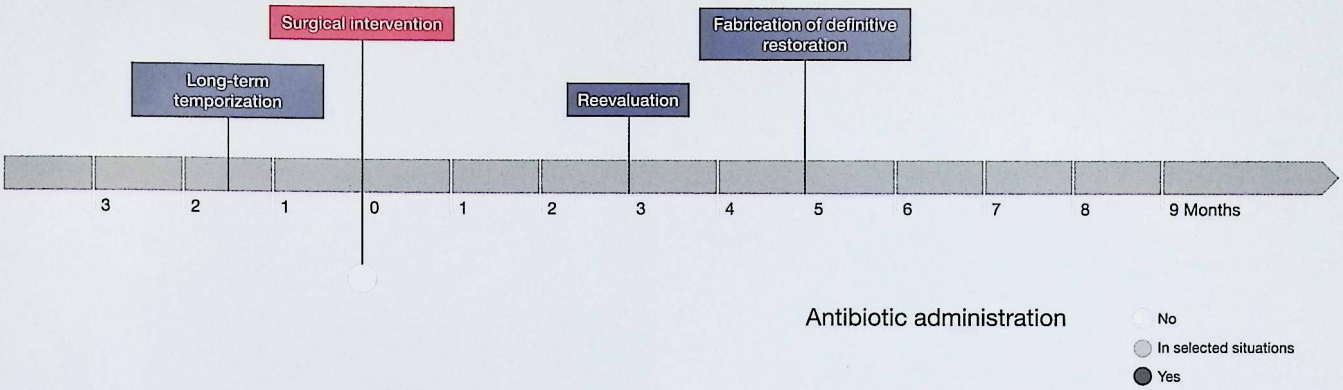
06. Thorough *root instrumentation* to remove all residual periodontal fibers on the root surfaces coronal to the new alveolar crest

07. *Apical flap stabilization* with 6-0 *mattress sutures* anchored onto the periosteum on the buccal side and onto the palatal masticatory mucosa on the palatal side, followed by *flap adaptation* with 7-0 *interrupted sutures* in the distal wedge area and between the first and second premolars

08. Application of a *periodontal dressing* coated with chlorhexidine powder to cover the parts of the wound left to heal by secondary intention in the interdental areas

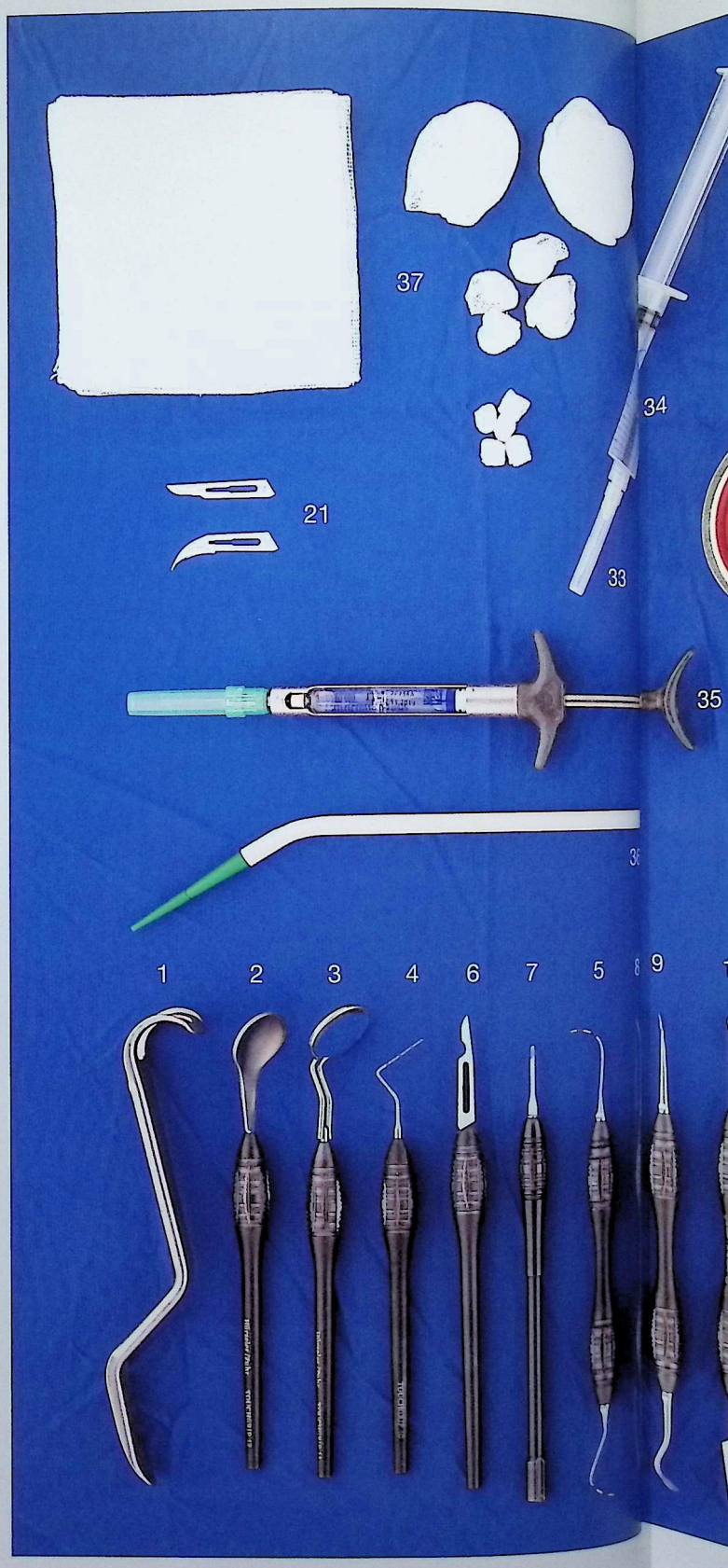
09. Comprehensive and complete *patient instructions*

TIME MANAGEMENT



WORKPLACE PREPARATION CHECKLIST

1 Cawood-Minnesota Retractor
2 Hilger Retractor
3 Mirror with Lip Holder
4 Perio Probe, straight
5 Nabers Furcation Probe
6 Scalpel handle for macroblades with No. 15c scalpel blade
7 Scalpel handle for microblades with Micro Blade SR
8 Papilla Elevator, double-ended
9 Raspatory with one straight and one angled working end
10 Raspatory with Prichard Retractor
11 Spring scissors
12 Needle holder, corrugated
13 Anatomical–surgical combination forceps
14 Dental tweezers
15 Metzenbaum scissors, curved
16 Artery clamps, straight
17 Needle holder, smooth, extra fine
18 Anatomical forceps, smooth, extra fine
19 Back Action Chisel
20 Fedi Bone Chisel
21 Scalpel blades: Nos. 12d and 15
22 SONICflex™ rootplaner tips: Nos. 24, 25, 26, and 27
23 Tray with surgical burs
24 Suture materials: SERALENE® DS-15 6-0, SERALENE® DS-12 7-0
25 Explorer
26 Universal curette Mini-Langer ¾
27 Excavator, fine, angled
28 Gracey curette 5/6
29 Gracey curette 11/12
30 Gracey curette 13/14
31 Chlorhexidine irrigation solution 0.1% in metal bowl
32 Sterile water in metal bowl
33 Blunt cannula, ø 0.90 x 40 mm
34 Syringe, 10 mL
35 Local anesthesia, Ultracain® D-S forte 1:100,000 1.7 mL
36 Microsurgical Aspirator, Surgitip-micro
37 Large and small swabs



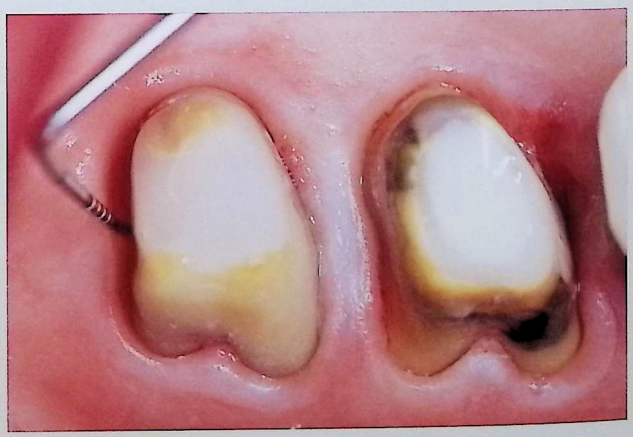

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LEARNING TARGETS

Apically repositioned flap procedures *for the elimination of deep subgingival restoration margins* at *maxillary buccal sites – Apically repositioned flap* procedures *for the elimination of deep subgingival restoration margins* at *maxillary palatal sites – "Distal wedge"* procedure *for the elimination of deep subgingival restoration margins* in the *maxilla – Bone contouring and root instrumentation* to achieve a *predefined gingival margin – Suturing technique* for apical flap repositioning in the maxilla

STEP-BY-STEP PROCEDURE





Figs 10-10 and 10-11 Initial clinical situation. Surgical treatment is preceded by the removal of the old and insufficient crowns, caries treatment, composite build-up restorations, endodontic revision treatment, and long-term temporization of teeth 26 and 27. Because the partially deep subgingival restoration margins of both teeth had violated the supracrestal tissue attachment, marginal gingivitis had occurred despite generally good oral hygiene by the patient. For precise surgical planning, the distance between the restoration margin and the marginal bone is measured by sounding the alveolar bone of the affected teeth with a periodontal probe. It is important to hold the probe as parallel to the tooth axis as possible while guiding it through the supracrestal fibers to the alveolar crest. In order not to cause any periodontal problems resulting from bone contouring, the radiograph taken in advance must be critically assessed to estimate the position of the furcation entries.





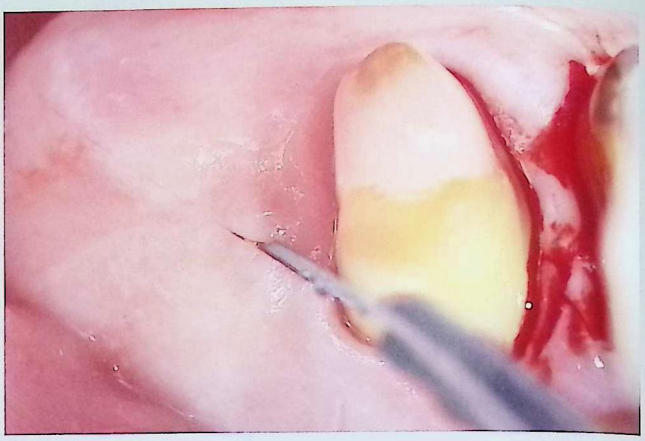


Figs 10-12 to 10-14 The incision design begins with the development of the surgical papillae on the buccal side. Using a No. 15c macroblade, the incision is made perpendicular to the surface at a depth of 1 to 1.5 mm, and is extended from mesial and distal into the interdental area of the respective teeth as far as technically feasible so as to minimize the later extent of alveolar bone exposure in the interproximal space. Care must be taken to ensure that the intersecting incision lines are clearly overcut.



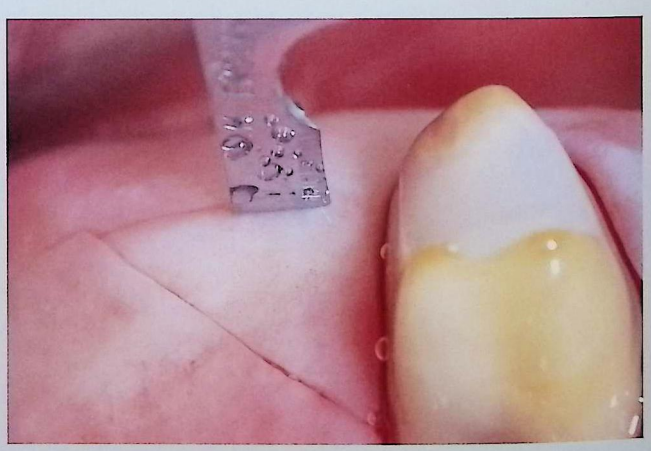
Fig 10-15 To achieve the goal of tension-free repositioning of the flap in the desired apical position without a vertical releasing incision, the papilla between the first and second premolars is sharply dissected with a single incision from distal to mesial to the tooth surface, creating a horizontal releasing incision.





Figs 10-16 and 10-17 The "distal wedge" procedure is required for apical displacement of the flap distal to the terminal molar. For this purpose, an incision is made starting at the center of the maxillary tuberosity, running obliquely from distal to buccal and mesial, directed toward the distal surface of the second molar. The incision is made to a depth of 1 to 1.5 mm, perpendicular to the surface.





Figs 10-18 and 10-19 Like the initial incision of the "distal wedge" procedure, the second incision is extended obliquely on the palatal aspect, and the intersecting incision lines are overcut. Together with the distal surface of the second molar, the two surface incisions form a triangle. To achieve the goal of primary flap adaptation without bone exposure, the distance between the two incisions at the distal surface of the terminal molar varies depending on the height of the palatal vault and the sum of the preoperative dimensions of the dentogingival complex, as determined by sounding, and the vertical dimension of alveolar bone that may have to be removed in this area. In this case, the dentogingival complex height is 6 mm, and slightly more than 2 mm of bone has to be removed to attain an epigingival restoration margin or a distance of 3 mm between the restoration margin and the marginal alveolar bone. In view of this patient's high palatal vault, the target distance between the two incisions is approximately two-thirds of slightly more than 8 mm, that is, about 5 to 6 mm.