4 Complications, Adverse Effects, and Patient-Centered Outcomes of Soft Tissue Augmentation Procedures and the Use of Gingival Soft Tissue Substitutes

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4.1 Complications, Adverse Effects, and Patient-Centered Outcomes of Soft Tissue Augmentation Procedures

4.1.1 Potential Complications and Adverse Effects Associated with Soft Tissue Grafting Procedures: "To Which Extent Are They Important?"

The base of systematic reviews available for gingival recession treatment, the use of CAF alone or in association with allogeneic, xenogeneic, or alloplastic biomaterials (e.g., matrix grafts or enamel matrix derivative) has been described as being less painful and more comfortable, due to the need of only one surgical site [1–7]. Conversely, it has been demonstrated that use of SCTG, FGG, and non-absorbable membranes has been associated with increased morbidity and some complications, such as postoperative pain, bleeding and swelling during the early phase of healing (Fig. 4.1a–c), and membrane exposure/contamination [1–7].

For instance, in a large practice-based study [8] considering the use of free gingival grafts (FGGs), subepithelial connective tissue grafts (SCTGs), and acellular dermal matrix grafts (ADMGs) for Class I and II root coverage, moderate to severe pain and swelling were the most significant adverse events, but less than 6 % of the sample experienced moderate or severe bleeding, and all of them were associated with the use of autogenous grafts [8]. The use of FGG was reported as the most painful procedure, followed by SCTG and ADMG. Additionally, longer chair-time procedures were straight associated to postoperative discomfort, such as pain and swelling, as well as the rate of pain and bleeding where superior for FGG than for SCTG [8]. On the other hand, it should be also noted that the incidence of infection (less than 1 %), bleeding (3.0 %), swelling (5.4 %), and pain (18.6 %) after the use of SCTG can be considered low to moderate [9].

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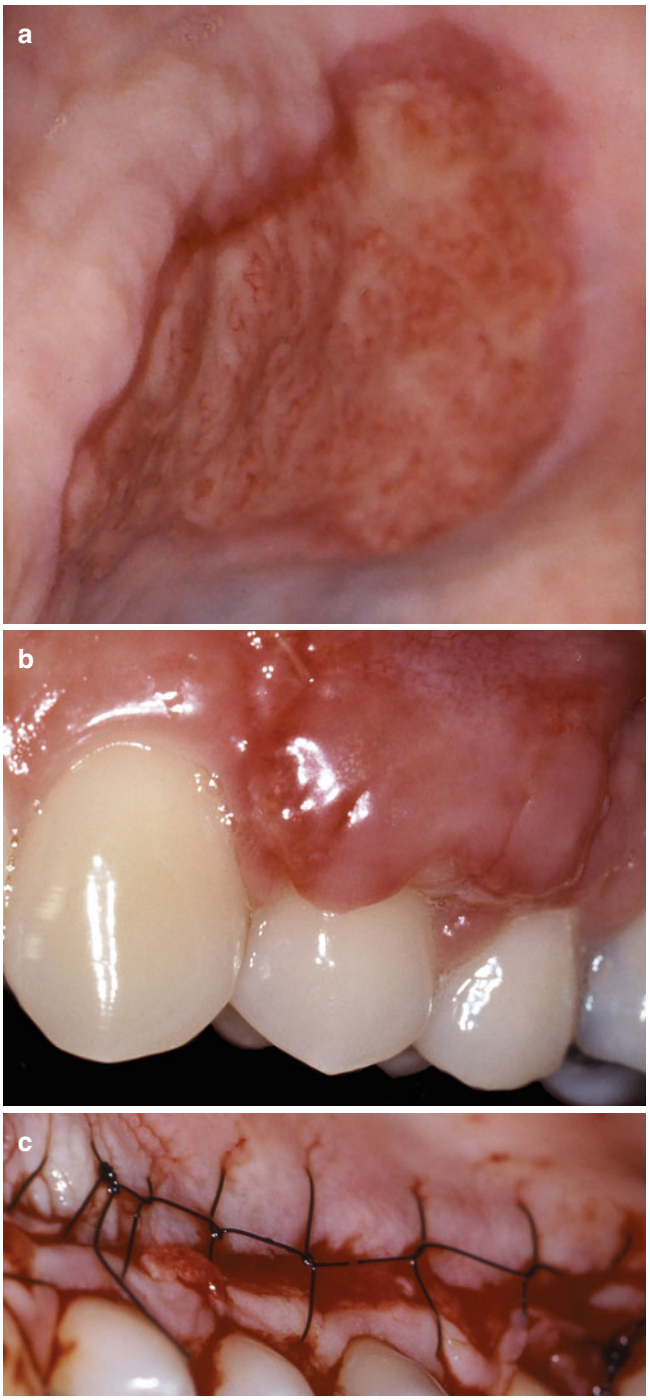


Fig. 4.1 Pain during early healing of donor sites of free gingival grafts caused by the exposure of the connective tissue layer of palatal gingival tissue (**a**). Swelling during early phase of healing of sites treated with subepithelial connective tissue grafts (**b**). Bleeding of a donor site of subepithelial connective tissue graft even after suture (**c**)

It is also important to highlight that despite the possible occurrence of some adverse events related to the treatment with SCTG (i.e., development of cyst-like areas [10, 11], root resorption [12, 13], or bone exostosis [14]), these were restricted to a very limited number of cases and cannot per se undermine the safety/success of autogenous grafts. Regarding the development of bony exostosis (i.e., unknown etiology of peripheral localized benign bone overgrowth, with a base continuous to the original bone and which seems to have a nodular, flat, or pedunculate protuberance) [15], these were also reported at sites where free gingival grafts (FGG) have been used to increase the amount of keratinized tissue (Fig. 4.2a–c). The reduced base of literature suggests that periosteal trauma/fenestration is probably the primary main-causing agent linked with exostosis development in grafted sited by FGG [16]. Likewise, and as explained in Chap. 3, additional reductions in the recession depth may occur after healing of the treated sites due to creeping attachment (Fig. 4.3a–i).

In addition, it has been clearly demonstrated that all periodontal plastic surgical procedures when properly performed are safe, as well as only a reduced number of patients can experience postsurgical complications (i.e., pain, swelling, or bleeding) or unusual healing outcomes [1–7].

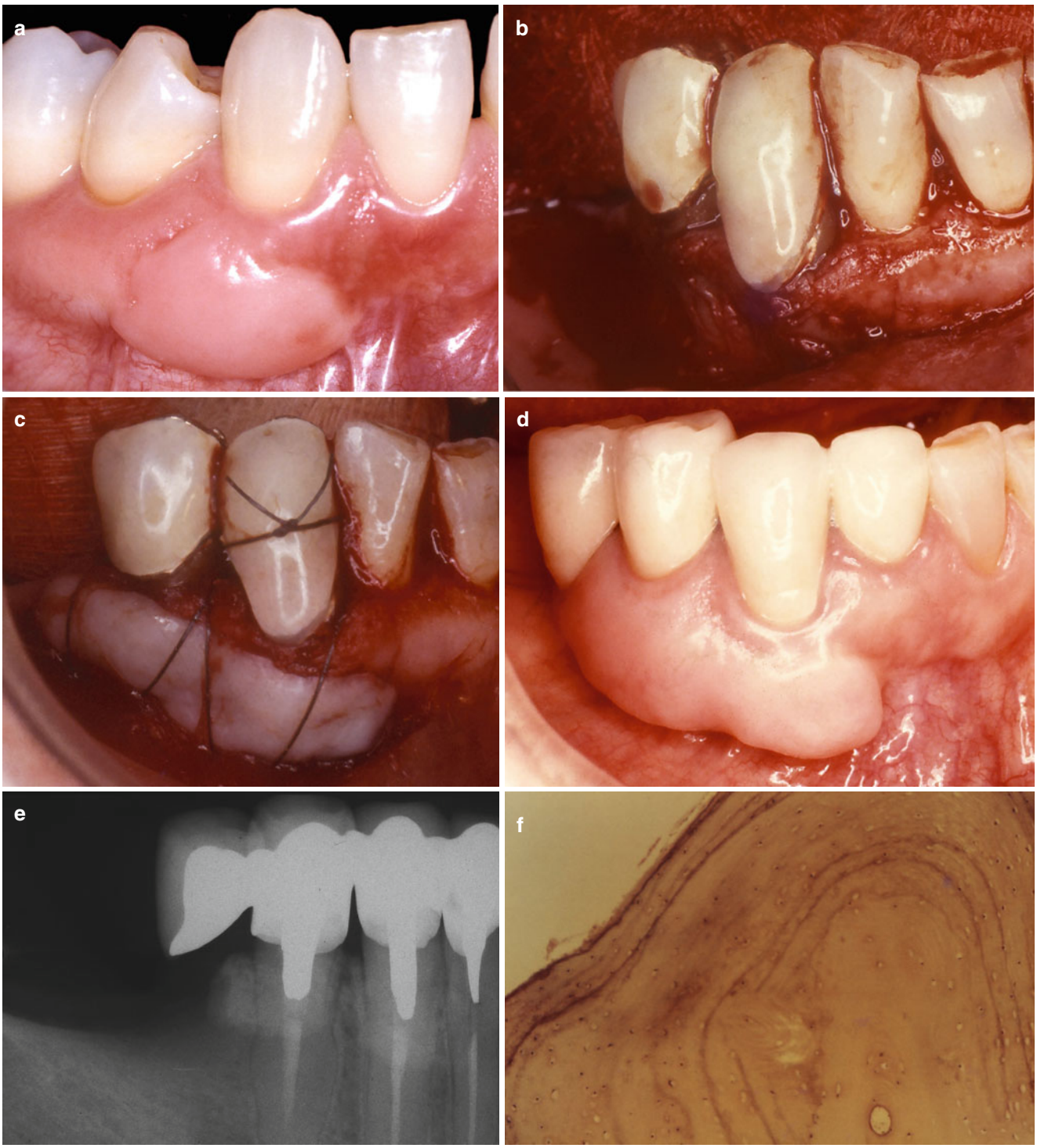


Fig. 4.2 Bone exostosis developed 5 years after frenectomy + periosteal fenestration + free gingival graft (**a**). Bone exostosis developed 15 years after a free gingival graft (**b**–**f**): accidental periosteal fenestration at teeth 44 & 43 (**b**), graft sutured (**c**), pronounced overgrowth at the graft site (**d**), increased radiopacity during radiographic exam (**e**), and very dense lamellar bone formation at graft site compatible to the exostosis diagnosis (**f**) (Figures originally published at Chambrone and Chambrone [16])

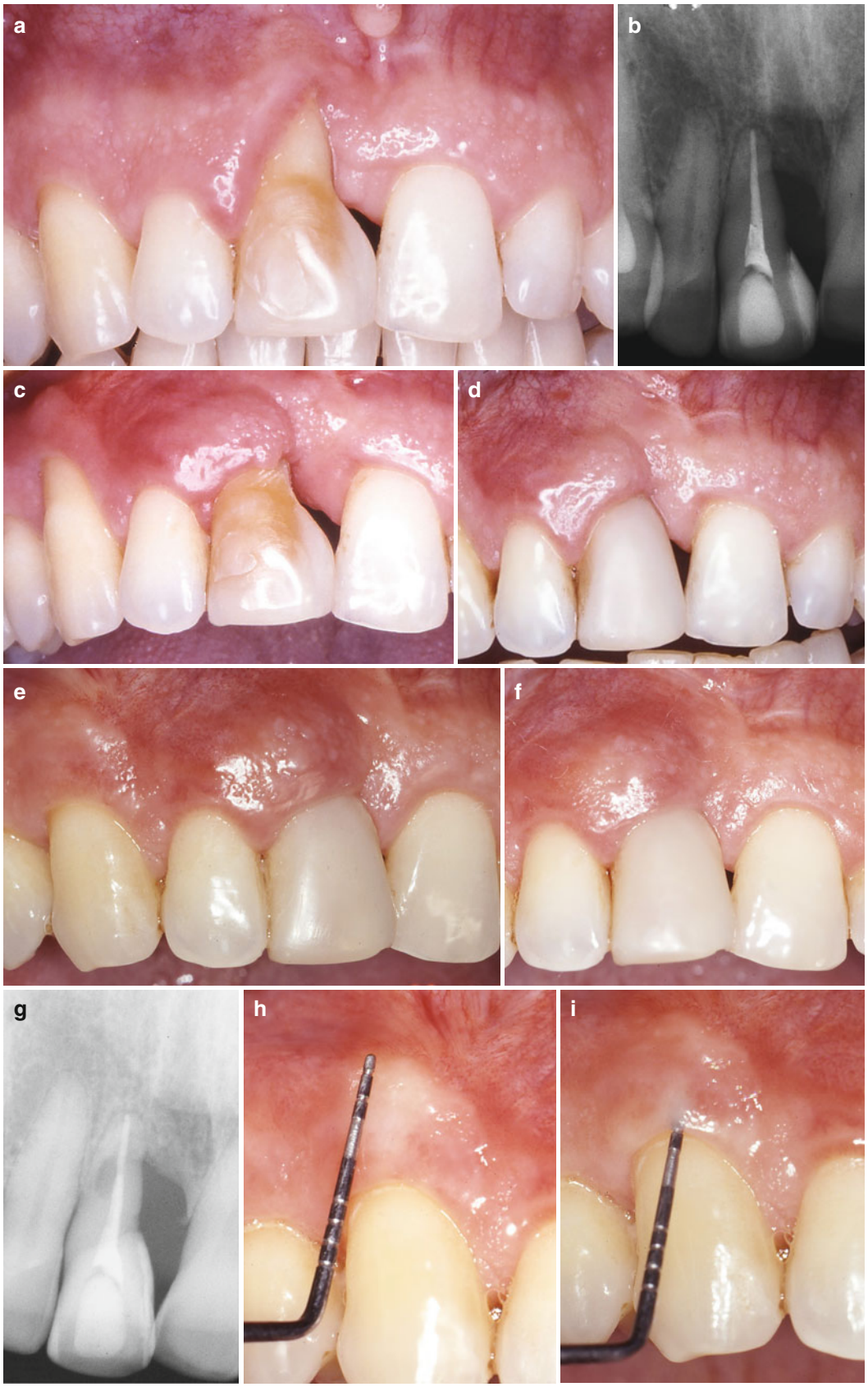


Fig. 4.3 (**a**–**i**) Class IV – Gingival recession in a heavy smoker patient >20 cigarettes a day (**a**),, baseline radiography (**b**), 4 months after a laterally positioned flap – presence of gingival recessions at tooth 13 (donor site) and 11 (recipient site) (**c**, **d**). 8 years follow-up – clinically relevant creeping attachment was evident on the donor and recipient sites (**e**, **f**) – 8 years follow-up radiography (**g**). Amount of creeping attachment achieved 8 years after surgery (**h**). Probing depth compatible to a health condition (**i**) (Figures originally published at Chambrone and Chambrone [28])

4.1.2 Patient-Centered Outcomes: "The Role of a Patient as the Clinician Coworker"

As reported previously, it can be argued that patients might prefer procedures involving only one surgical site when those potential early postoperative complication/adverse effects are taken into account; however, data included in previous systematic reviews also showed that these outcomes were not associated with the final esthetic/functional outcomes [1–7].

With respect to the influence of root coverage on cervical dentin hypersensitivity and quality of life of patients, a recent study on the treatment of Class I GRs treated with SCTG + CAF demonstrated that thermal [cold] and evaporative [air blast] stimuli can be significantly reduced 3 months postsurgery [17]. Yet, the treatment of recession defects (independent of the amount of root coverage achieved and the treatment approach used) positively influenced patients' oral health-related quality of life [17, 18].

Concerning patients' perceptions and requests for treatment and postsurgical satisfaction, it has been recently considered that perception of buccal defects by patients should be taken into consideration during decision-making [19]. Most of the patients don't mind the presence of GR, as well as considered such defects asymptomatic in nature and with no esthetical and/or functional relevance (73 %) [19]. In addition, 2/5 of the patients' requests for surgical correction of the defects occurred because of esthetic concerns and only 1/5 as a result of cervical dentin hypersensitivity [20].

Taken into account the patient-reported outcomes on esthetical and functional demands, it has been suggested that most of the graft, flap, and soft tissue substitutes provide similar color/texture of the tissues, except for the use of free gingival grafts (Fig. 4.4a–h) [1–7]. On the other hand, less traumatic procedures, such as CAF without vertical incisions, seem to offer better postoperative course during early healing [7].

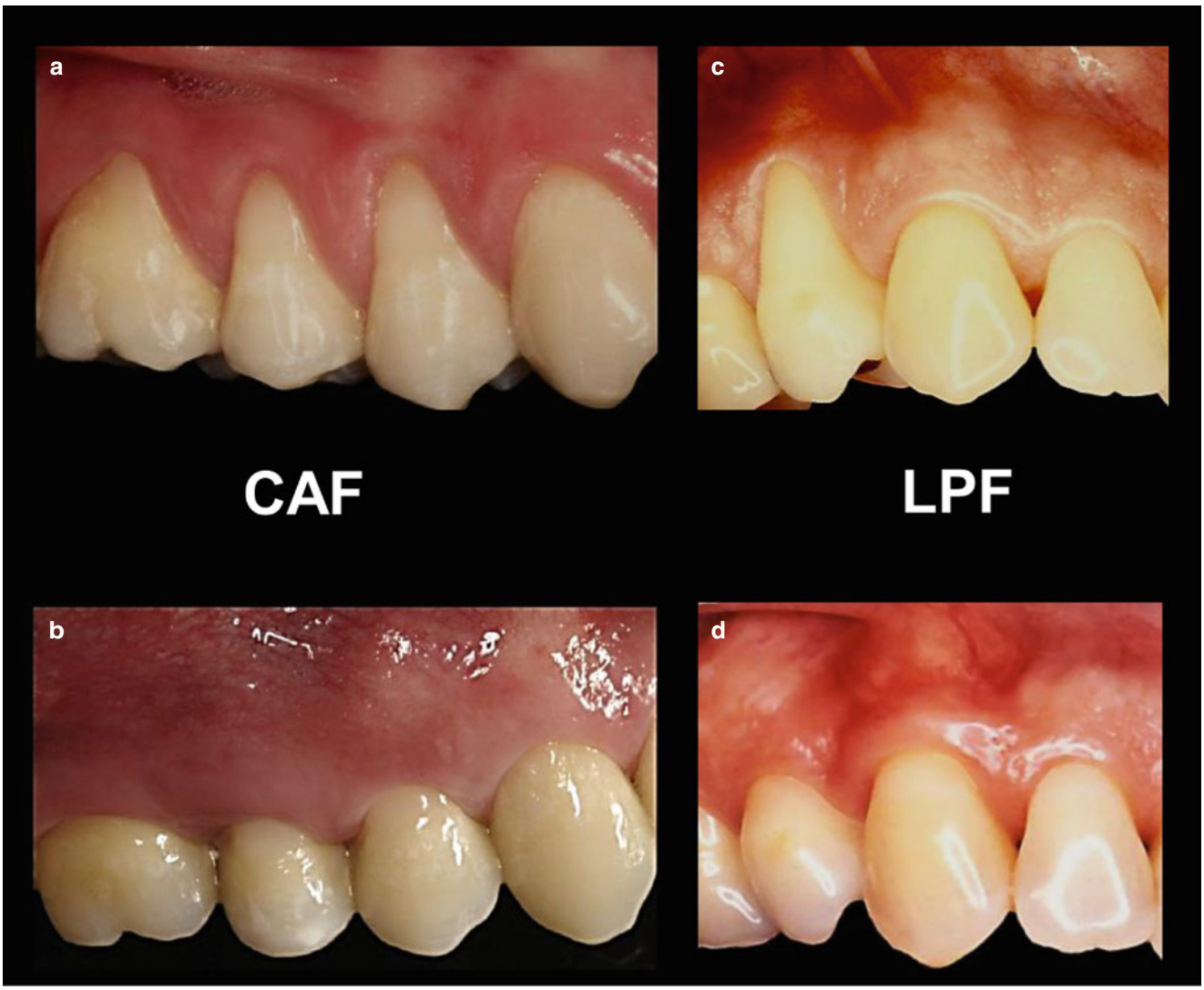


Fig. 4.4 Best color match and esthetics – flaps versus grafts. *CAF* coronally advanced flap (**a**, **b**), *LPF* laterally positioned flap (**c**, **d**), *SCTG* subepithelial connective tissue grafts (**e**, **f**), *FGG* free gingival grafts (**g**, **h**)

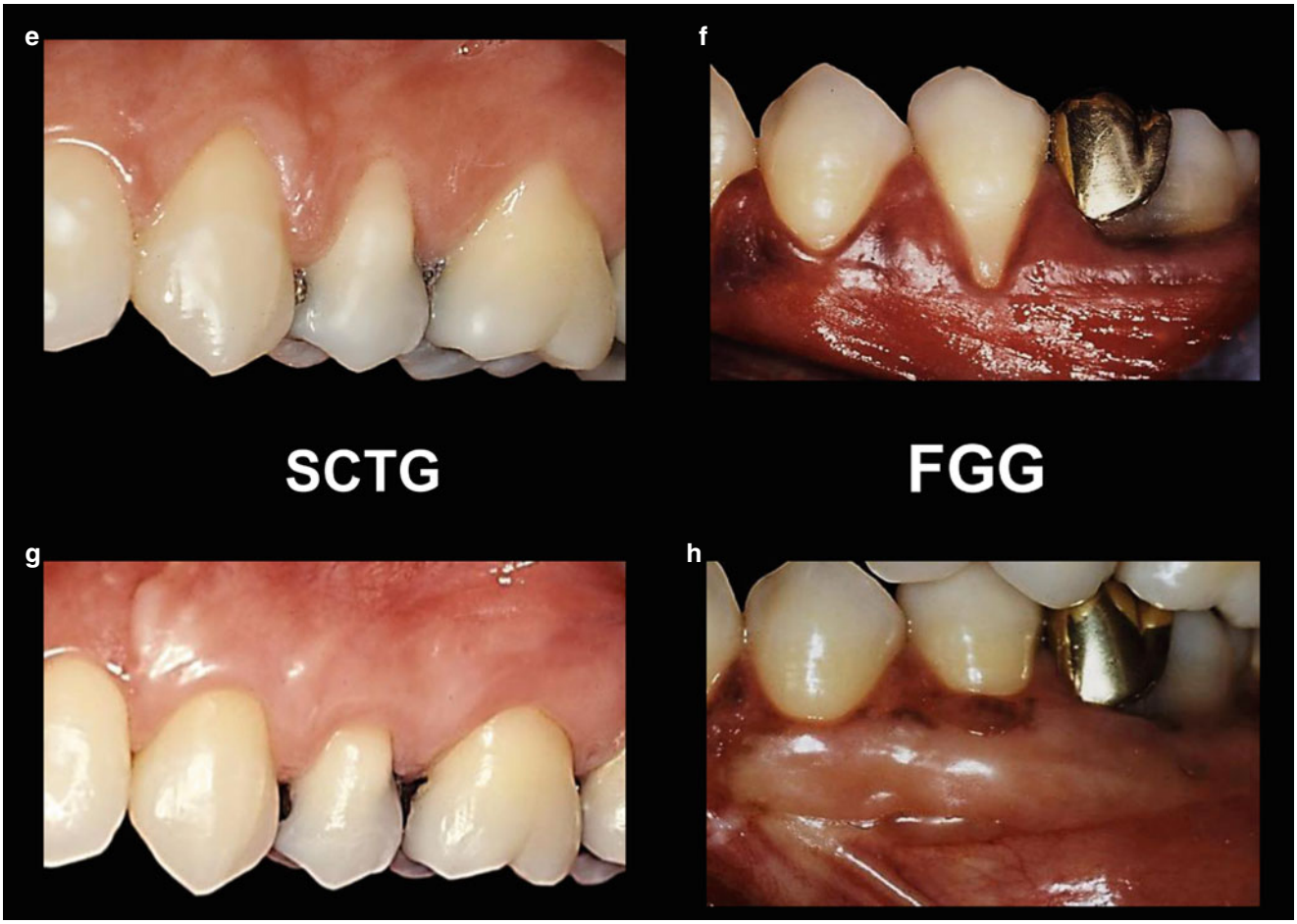


Fig. 4.4 (continued)

4.1.3 Clinical Concluding Remarks: "To Treat or Not to Treat Recession-Type Defects and Sites Lacking Keratinized Tissue"?

In clinical terms, it is clear that soft tissue augmentation procedures are safe and very well accepted by patients. The potential complications and adverse effects associated with such procedures are restricted to a limited number of cases and cannot per se undermine the safety/success of autogenous grafts. However, it is also clear that less traumatic procedures, with less chair time and involving only one surgical site, are preferred by most patients. These preferences are associated only with the surgical technique chosen and to some degree of pain, swelling, and/or bleeding some patients may experience at the early phases of healing of donor sites of autogenous grafts, but they do not have any impact on the final esthetical/functional outcomes or even amount to contraindications for treatment.

It is clear that less traumatic procedures, with less chair time and involving only one surgical site, are preferred by most patients. Independent of such preference, most of the treated patients considered esthetics as their main concern and, in their great majority, the final outcomes of the performed surgical procedure (irrespective of inclusion of one or more surgical sites) fulfilled their personal expectations. However, differences among patients' and clinicians' expectations and the manner they consider the success of treatment may be accounted as well. Apart of such preferences, most of the treated patients considered esthetics as their main concern and, in their great majority, the final outcomes of the performed surgical procedure may fulfill patients' personal expectations [1–7].

Critical Summary of the Results of Systematic Reviews

Systematic reviews co*nclusions*: All periodontal plastic surgery procedures are safe, as well as no relevant detrimental effects have been demonstrated associated with the main RC employed in daily practice [1–7]. On the other hand, there is not enough evidence to support or refute the assumption that RC may decrease hypersensitivity [17].

Summary of the reviews and critical remarks: Most of the research on the treatment of recession-type defects highlights the positive effect of treatment in terms of defect- and patient-centered outcomes. The incidence of adverse effects, such as discomfort with or without pain, is very low, and when present, these may occur at early phase of healing. Additionally, such events do not lead to changes in the final anticipated functional (root hypersensitivity) and/or esthetical outcomes [1–7].

Evidence quality rating/strength of recommendation (*ADA 2013*) [21]: Strong – Evidence strongly supports providing these interventions (i.e., treatment of recession-type defects and keratnized tissue augmentation)

4.2 The Use of Soft Tissue Substitutes

4.2.1 Historical Note and Types of Substitutes

The use of soft tissue substitutes for root coverage procedures, treatment of alveolar ridge deformities, and augmentation of the keratinized tissue band has been broadly proposed since the late 1990s. Specifically to the potential materials capable to be used in periodontal and peri-implant plastic surgery, allogenic and xenogeneic grafts have been developed [1, 3–7], and the main commercial brands are depicted below:

- The Alloderm® Regenerative Tissue Matrix (BioHorizons IPH Inc., Birmingham, AL, USA) or ADMG is the most studied soft tissue substitute since its development in 1994. It is an allograft material obtained from a human donor skin tissue through a process that removes its cell components (in order to remove potential sources of disease transmission and immunologic reaction), while preserving the remaining bioactive components and the extracellular matrix, which is subsequently freeze dried [22–24]. According to its manufacturer, it "supports tissue regeneration by allowing rapid revascularization, white cell migration and cell population – ultimately being transformed into host tissue for a strong, natural repair."
- The Puros® Dermis Allograft Tissue Matrix (Zimmer Dental Inc., Carlsbad, CA, USA) is an allograft material (i.e., sterile dehydrated dermis from donated human) that "retains the natural three-dimensional collagen structure/matrix and mechanical properties of native dermis," as well as it "provides a natural collagen scaffold to support replacement by new endogenous tissue."
- The PerioDerm™ Acellular Dermis Soft Tissue Matrix (DENTSPLY International, Inc., Tulsa, OK, USA) is a freeze-dried allograft material derived from donated human skin, and it "is minimally processed to remove epidermal and dermal cells (viable cells and antigens) to minimize the risk of rejection and inflammation of the surgical site while preserving the extracellular matrix (the framework for cellular infiltration and vascularization)." It is also described by "supporting the migration of host cells from wound margins and surrounding tissues."
- The Geistlich Mucograft® (Geistlich Pharma AG, Switzerland) is a purified, nonantigenic pure porcine collagen bilayer matrix. As described by its manufacturer, one of the layers is compact ("compact collagen fibers that protect against bacterial infiltration in open healing situations and allow tissue adherence as a prerequisite for favorable wound healing"), while the other is spongious ("a thick [2.5–5.0 mm], porous collagen spongious structure that should be placed in contact with the host tissue").

In addition, the association of other biomaterials has been used to improve the outcomes of CAF-based procedures. Of them, the porcine enamel matrix derivative protein (EMD – Straumann® Emdogain, Straumann Holding AG, Basel, Switzerland) has been used for more than 10 years as an interesting and safe approach. Despite the additional costs related to the purchase of this biomaterial, it has been demonstrating superior outcomes in recession depth reduction, concomitant clinical attachment level, and keratinized tissue width gain when compared to CAF alone, as well as in regenerating part of the periodontal tissues at recession defects [1, 3–7].

4.2.2 Type of Defect/Condition to Be Indicated

Treatment of localized or multiple Class I and II GR [25] (with any of the abovementioned biomaterials), as well as for the treatment of alveolar ridge deformities (gain in soft tissue volume) and increase in the keratinized tissue width/band around teeth and implants (except for the enamel matrix derivative)

4.2.3 Type of Defect/Condition Not to Be Indicated

Non-submerged surgical root coverage sites

4.2.4 General Surgical Aspects on the Use of Soft Tissue Substitutes

Overall, the allogeneic grafts should be rehydrated by sterile saline in room temperature for at least 2 min, whereas the xenogeneic collagen matrix and the enamel matrix derivate are ready to use (the collagen matrix need to be only trimmed to size and sutured to the recipient site dry). Overall, they should be used in the same manner of SCTG, but they have to be completely covered by a coronally advanced flap (*the Mucograft may be sutured exposed to the oral cavity in sites requiring only keratinized tissue augmentation).

4.2.5 Clinical Remarks: Implications for Practice and Clinical Decision-Making

As reported in previous chapter, the use of SCTG-based procedures provided the best short- and long-term clinical

outcomes to the patients (i.e., recession depth reduction, clinical attachment level, and keratinized tissue gain), as well as cost-benefit ratio. Apart from these conditions, the use of acellular dermal matrix grafts or xenogeneic collagen matrix is certainly adequate and harmless to soft tissue substitutes to be used in areas demanding root coverage or soft tissue/keratinized tissue augmentation in patients with great demands of donor tissue (e.g., patients with multiple recession-type defects) or patients who do not want to be submitted to a secondary surgical procedure at the palatal vault. Similarly, the enamel matrix derivative, at short and long term, leads to positive outcomes when used for conditions involving root coverage associated to keratinized width increase. Histologically, it may lead to the formation of a long junctional epithelium (over the previously exposed root surface) and connective tissue attachment with fibers parallel to the root surface (for root coverage procedures), but it is expected to have partial regeneration of the cementum, alveolar bone, and periodontal ligament when Emdogain is used.

Concerning exclusively the improvement of the keratinized tissue band in sites not requiring root coverage, free gingival grafts are still considered to be the "gold standard" procedure because of its incomparable (or higher) rate of success, but graft substitutes may be used as possible options to palatal tissue harvesting for sites requiring gingival augmentation (Figs. 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13, 4.14, 4.15, 4.16, 4.17, and 4.18) [27].

Critical Summary of the Results of Systematic Reviews

Systematic reviews conclusions: Regarding the treatment of gingival recessions, EMD and dermal matrix grafts (mainly ADMG) can significantly improve recession depth, clinical attachment level, and the keratinized tissue band (MRC and CRC are comparable to ones reported by SCTG). Xenogeneic collagen matrix (XCM) may be used as well, but the amount of information on this material is still limited [1, 3–7]. For the increase of the width and volume of keratinized tissue, ADMG and XCM performed worse than SCTG or FGG [26].

Summary of the reviews and critical remarks: The base of evidence on ADMG-based procedures is somewhat long and solid. In statistical terms, there is no significant differences between ADMG and SCTG procedures in terms of MRC and CRC (but SGTG showed a trend of better outcomes), but ADMG may provide 15 % more MRC than CAF alone (at 6 months). For XCM, it led to 9 % less MRC than SCTG [7]. For non-root coverage procedures, short-term evidence suggests the use of ADMG and XCM as safe substitutes to autogenous grafts [27].

Evidence quality rating/strength of recommendation (*ADA 2013*) [21]: Strong (for EMD and ADMG), evidence strongly supports providing this intervention; and in favor (for XCM), evidence favors providing this intervention.

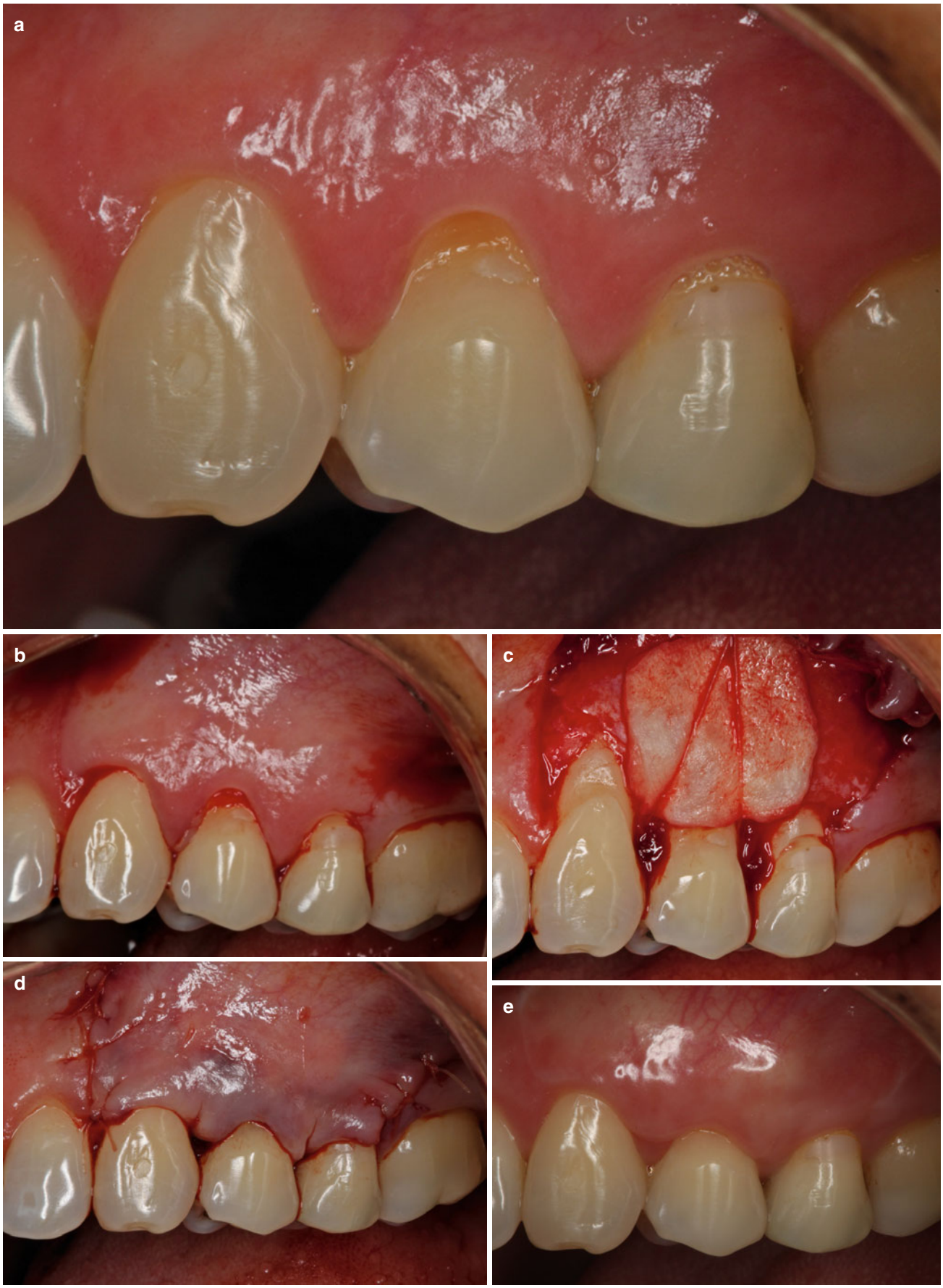


Fig. 4.5 (**a**–**e**) Case I – Single class I gingival recession on tooth 24 associated to a noncarious cervical lesion treated with Alloderm® Baseline (**a**). Horizontal and vertical incisions performed (**b**). Graft sutured over the exposed root surface at the level of the probable cementoenamel junction (**c**). Flap coronally advanced and sutured covering the graft completely (**d**), 4 months follow-up (**e**)

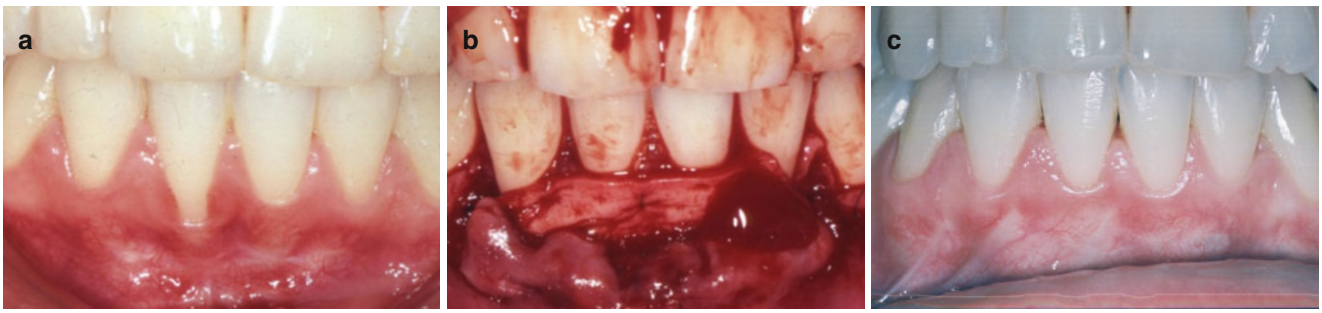


Fig. 4.6 Case II (**a**–**c**) – -Single class II gingival recession over tooth 41 treated with Puros Dermis

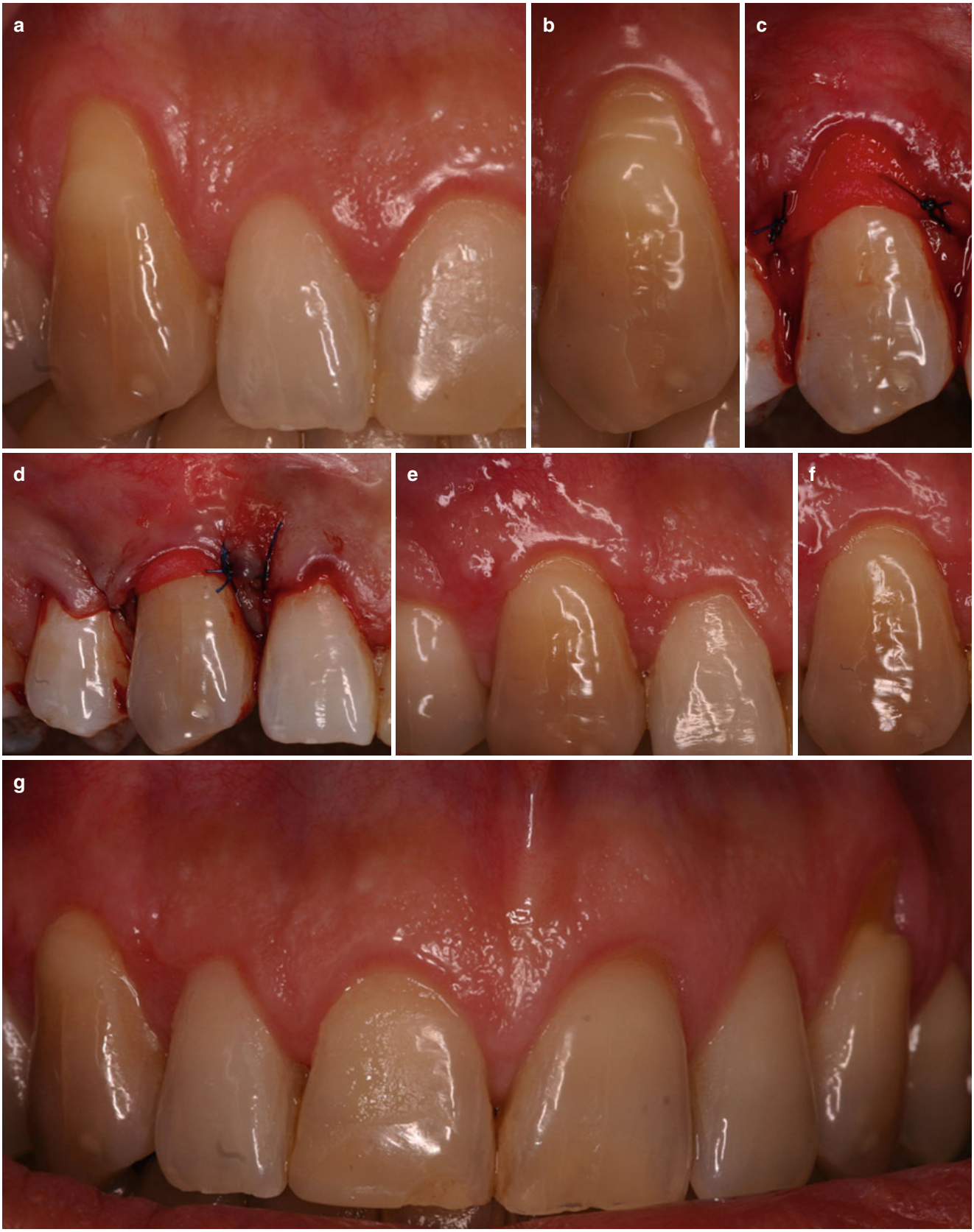


Fig. 4.7 (**a**–**g**) Case III – Single class II gingival recession on tooth 13 associated to a noncarious cervical lesion treated with Puros Dermis®. Baseline (**a**, **b**). Graft sutured over the exposed root surface at the level of the cementoenamel junction (**c**). Flap coronally advanced and sutured covering the graft as much as possible (**d**), 1-year follow-up (**e**–**g**)

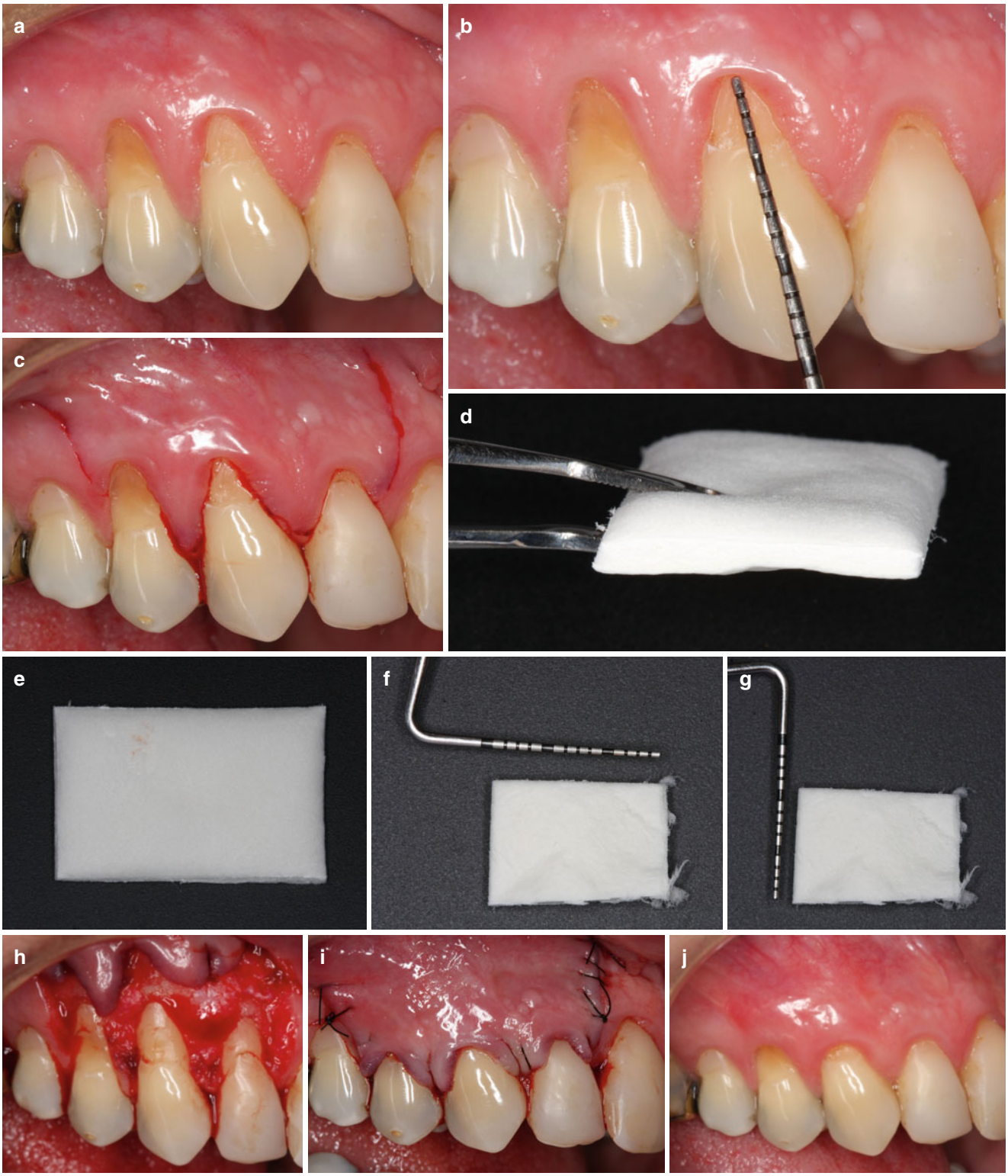


Fig. 4.8 (**a**–**j**) Case IV – Multiple class I gingival recessions on teeth 12, 13, and 14 associated to noncarious cervical lesion treated with Mucograft®. Baseline (**a**). Recession depth of tooth 13 (**b**). Horizontal and vertical incisions performed (**c**). 3D aspect of the soft tissue substitute (**d**), graft (general view) (**e**), graft height (**f**), graft width (**g**), flap raised (**h**), flap coronally advanced and sutured covering the graft completely (**i**), 1-year follow-up (**j**)

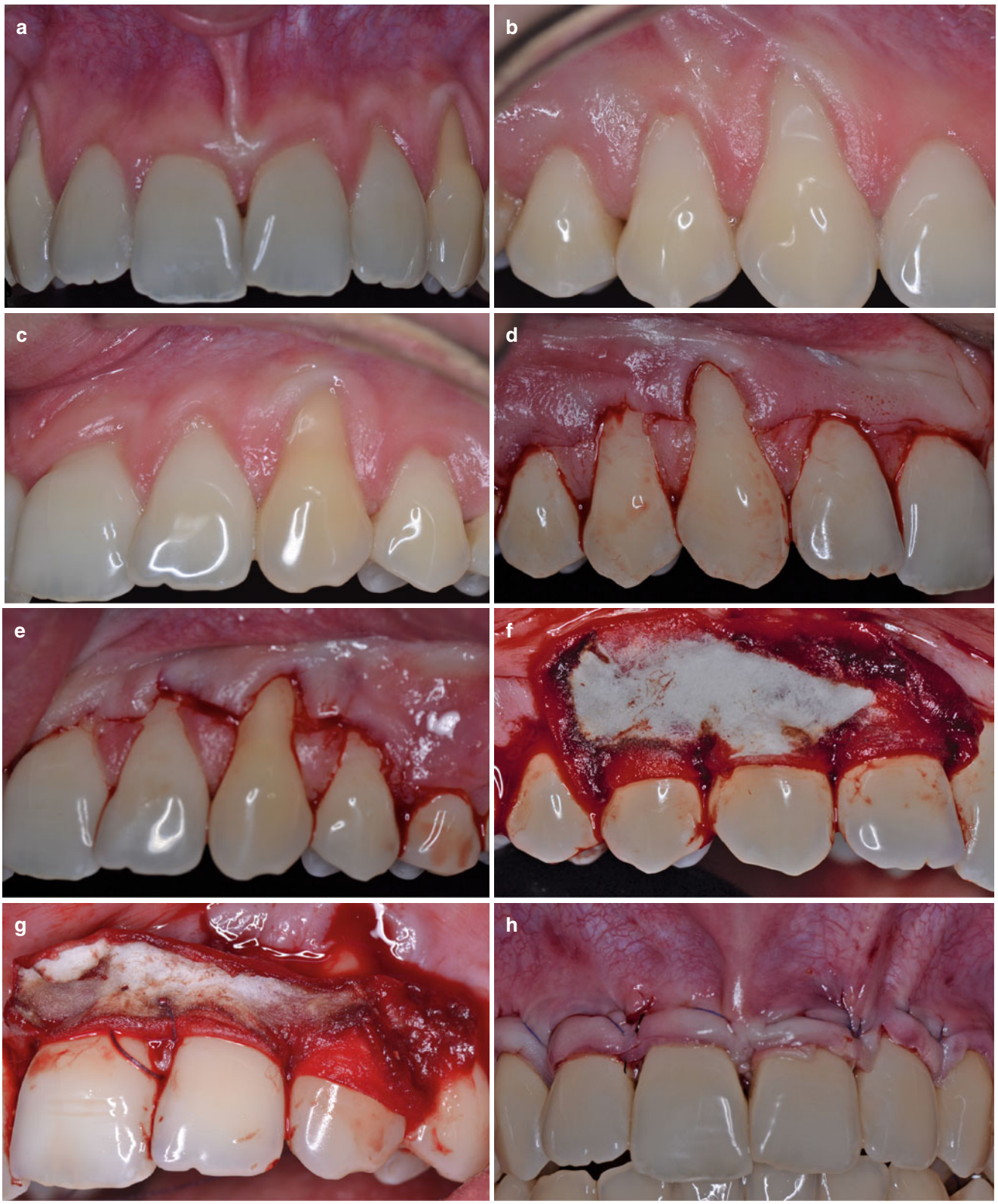
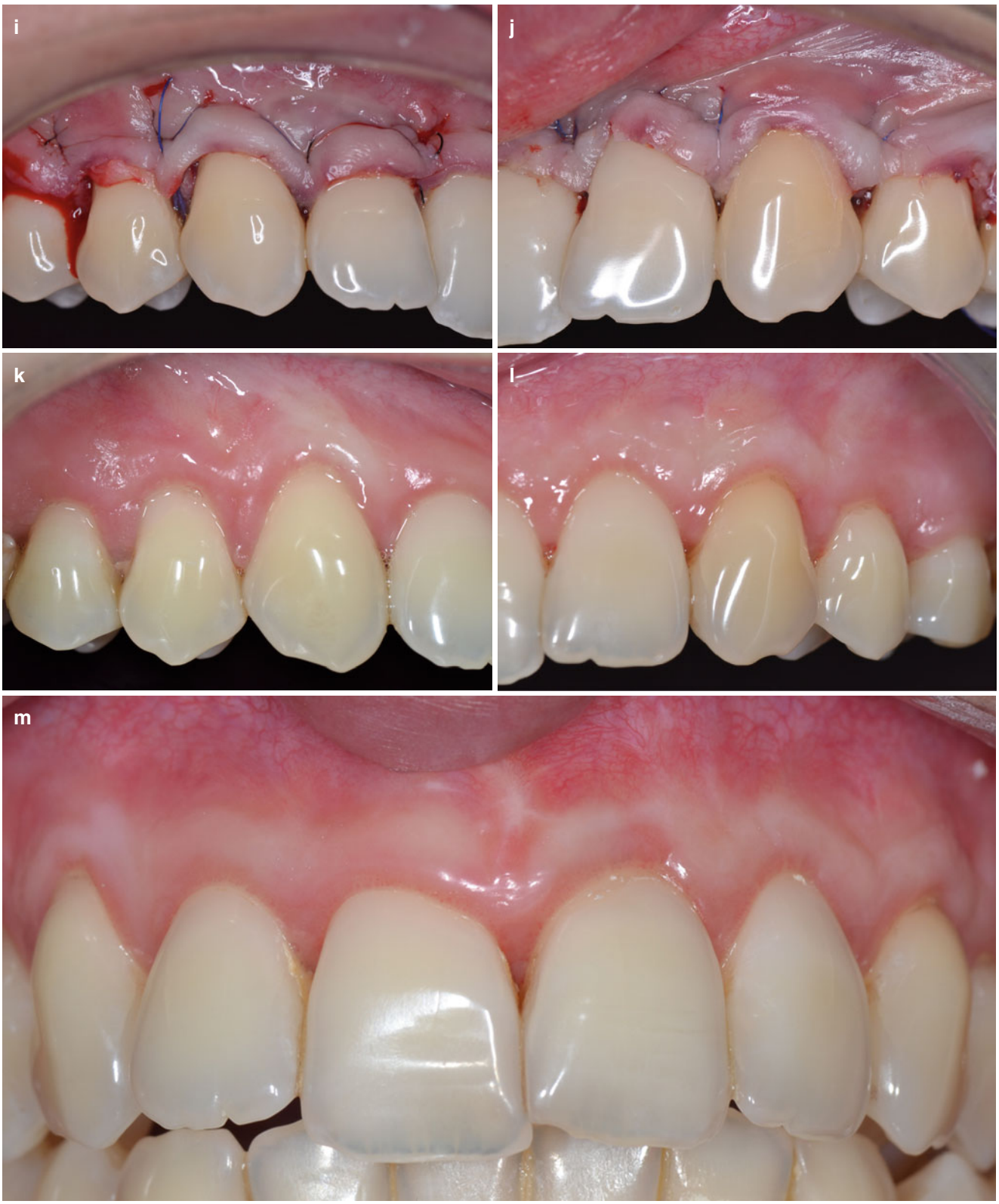


Fig. 4.9 (**a**–**m**) Case V – Multiple class I and II gingival recessions on the anterior maxillary teeth treated with Mucograft®. Baseline (**a**–**c**), horizontal and papillary incisions performed (**d**, **e**), graft sutured (**f**, **g**), flap coronally advanced and sutured covering the graft completely (**h**–**j**), 8 months follow-up (**k**–**m**)



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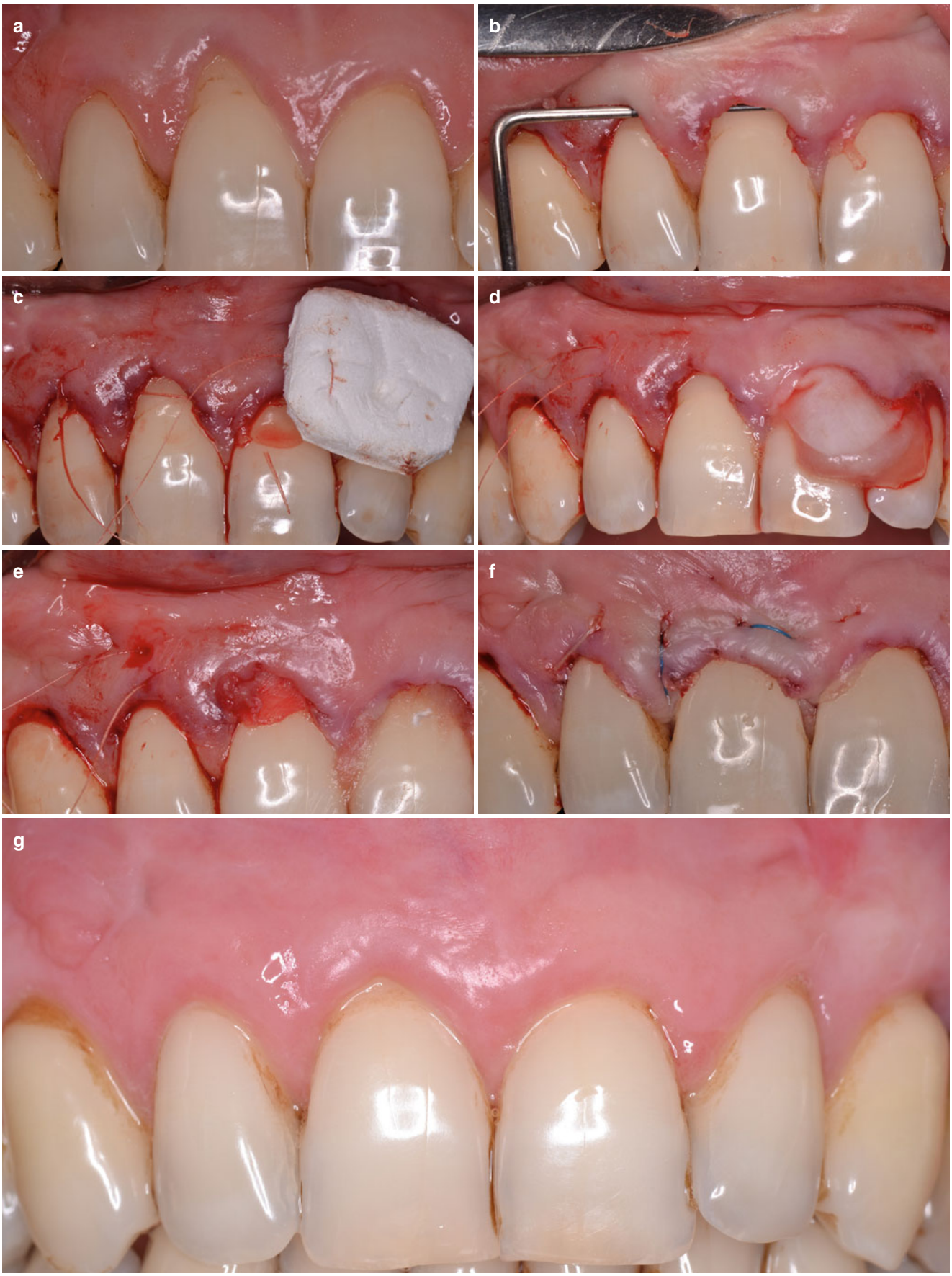


Fig. 4.10 (**a**–**g**) Case VI – Multiple class I gingival recessions on teeth 12, 11, and 21 treated with Mucograft®. Baseline (**a**), tunnel flap raised (**b**), graft (**c**), graft being positioned (**d**), graft positioned (**e**), tunnel flap coronally advanced and sutured covering completely the graft (**f**), 1 year follow-up (**g**)

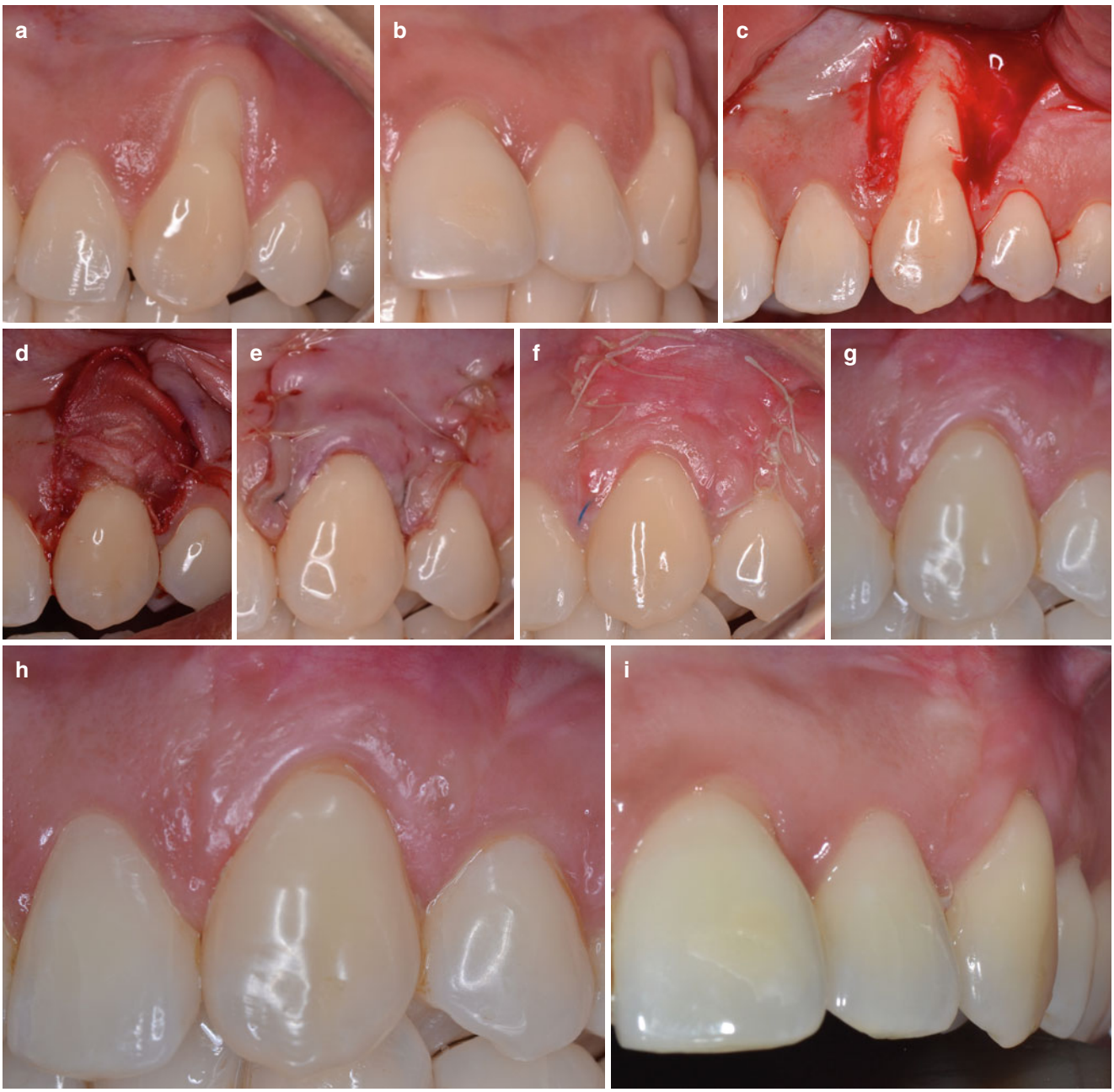


Fig. 4.11 (**a**–**i**) Case VII – Single class II gingival recession on tooth 23 associated with a noncarious cervical lesion treated with Mucograft®. Baseline (**a**), evident loss of root dentin (**b**), flap raised (**c**), graft sutured over the root surface (**d**), flap coronally advanced and sutured covering completely the graft (**e**), 2 weeks follow-up (**f**), 8 weeks follow-up (**g**, **h**), 2 years follow-up (**i**)

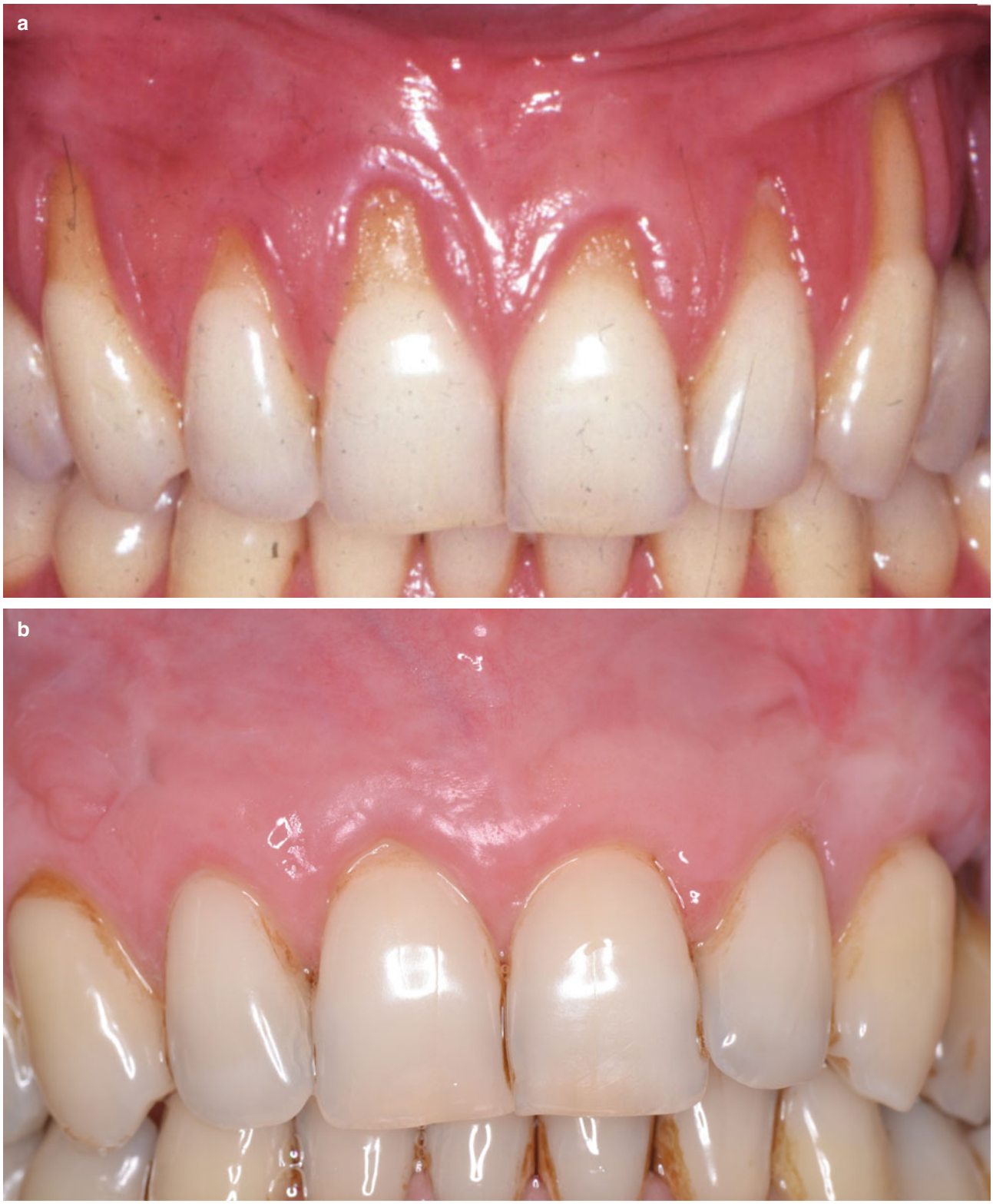


Fig. 4.12 (**a**, **b**) Case VIII – Multiple class I and II gingival recessions on the anterior segment of maxilla of a heavy smoker patient (>20 cigarettes a day) treated with Alloderm®. Baseline (**a**), 2 years follow-up (**b**)

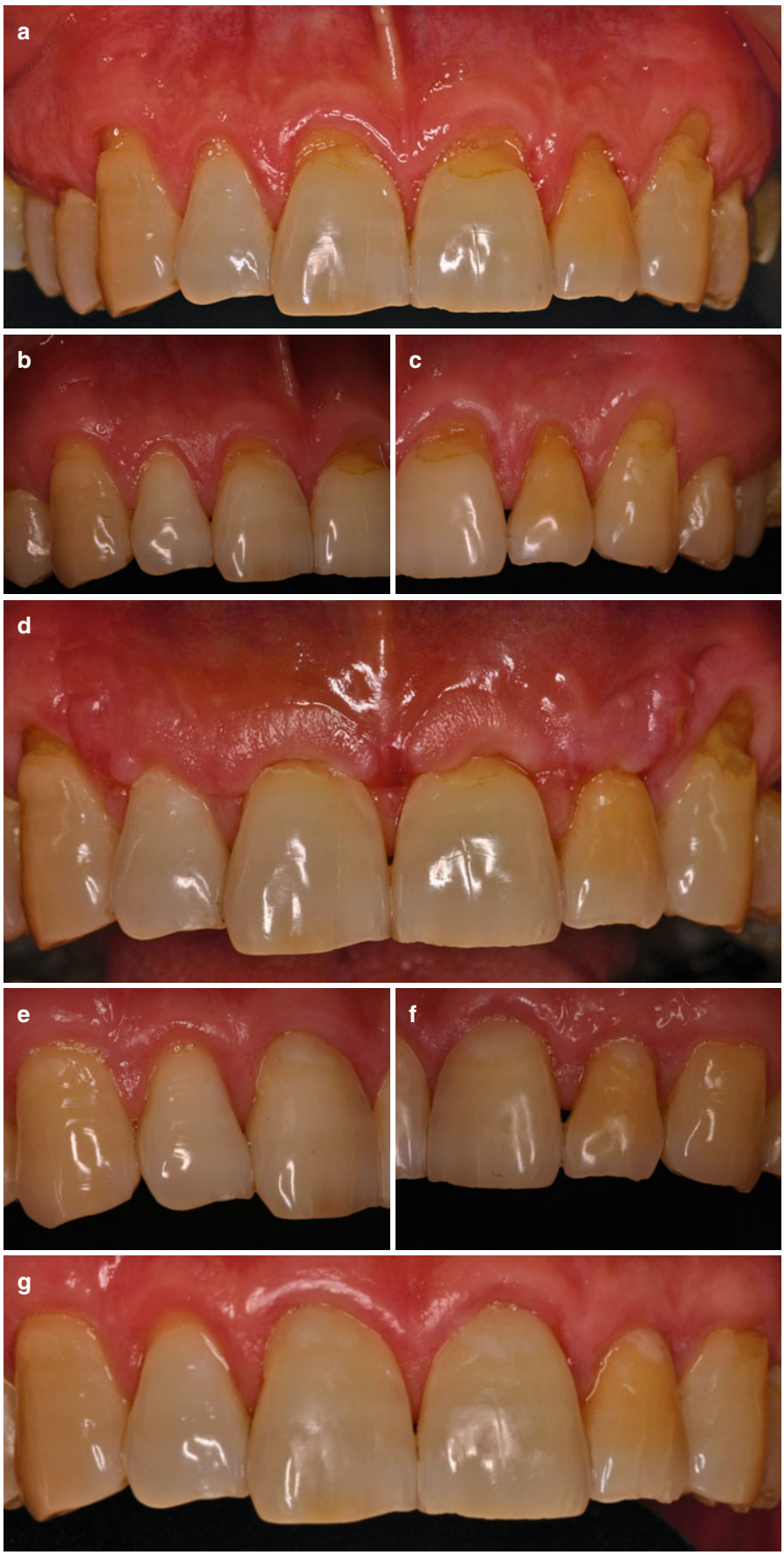


Fig. 4.13 (**a**–**g**) Case IX – Multiple class I and II gingival recessions associated to noncarious cervical lesions on the anterior segment of maxilla treated with platelet-rich fibrin. Baseline (**a**–**c**), 3 weeks follow-up (**d**), 1 year follow-up (**e**–**g**)

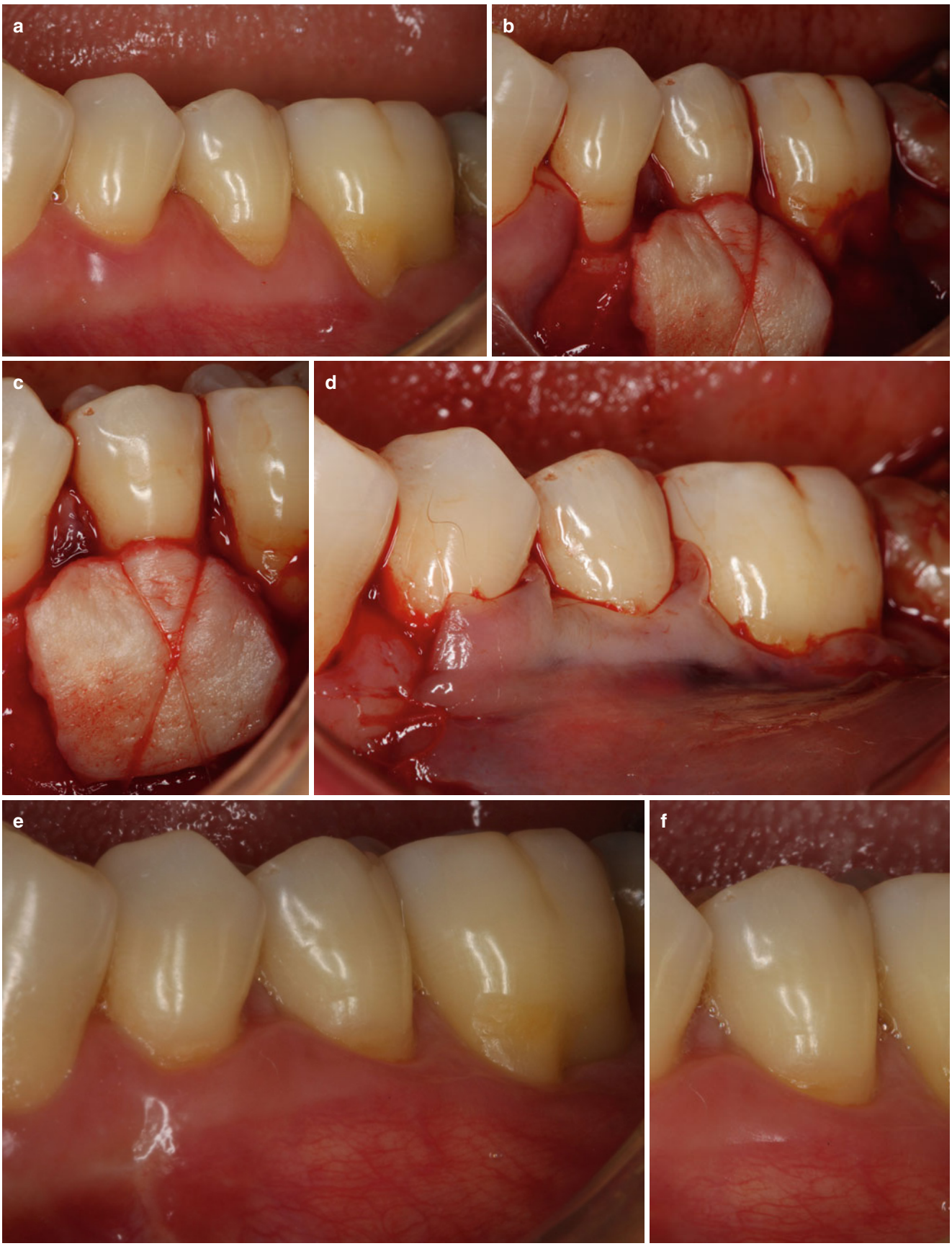


Fig. 4.14 (**a**–**f**) Case X – Single class I gingival recession on tooth 35 treated with Alloderm®. Baseline (**a**), graft sutured to the recipient site (**b**, **c**), flap coronally advanced and sutured covering the graft completely (**d**), 4 months follow-up (**e**, **f**)

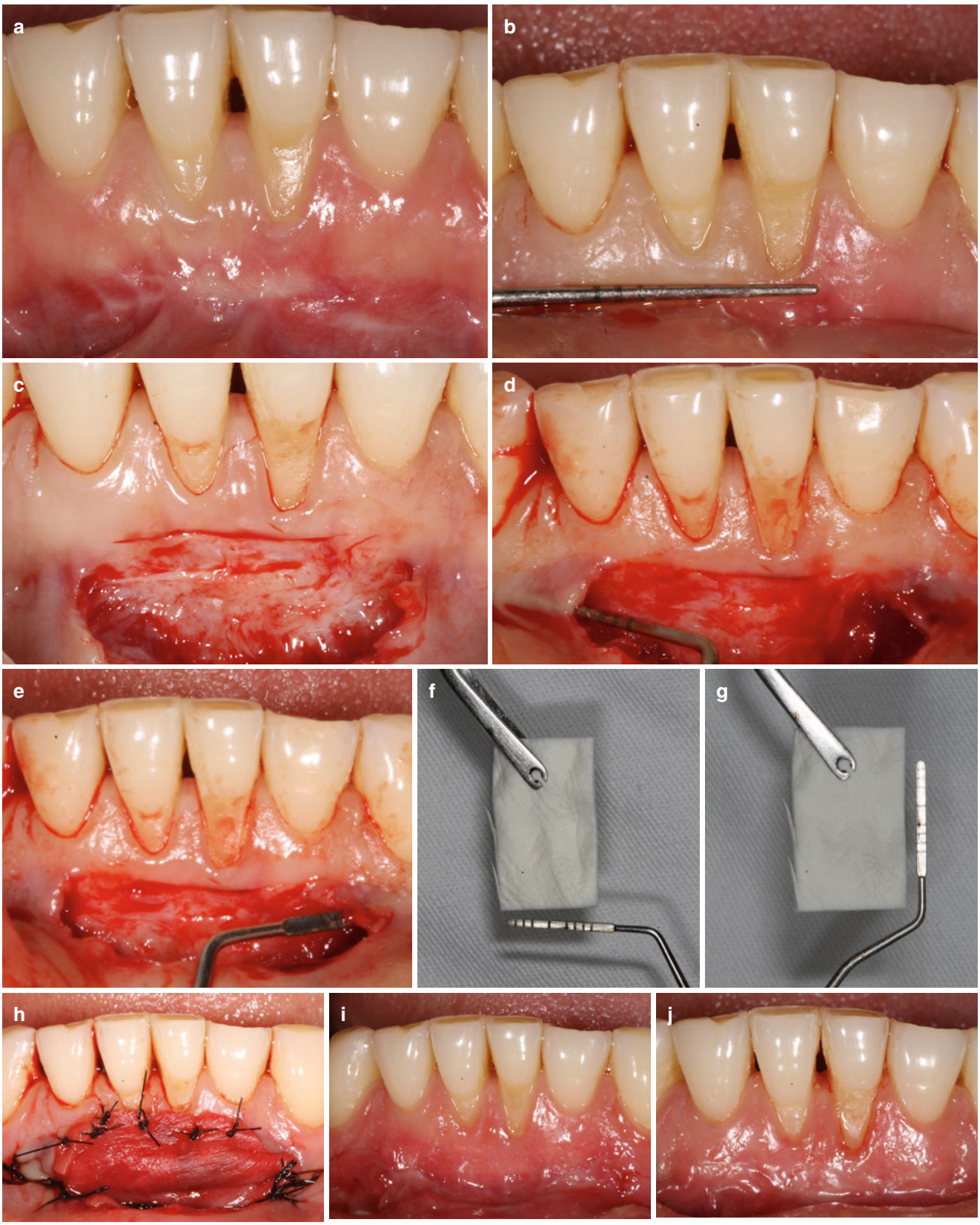


Fig. 4.15 (**a**–**j**) Case XI – Lip frenum removal at the anterior mandible associated to soft tissue grafting with Mucograft®. Baseline (**a**), lack of keratinized tissue (**b**), frenum removal (**c**), dissection of the recipient site to accommodate the graft (**d**, **e**), dimensions of the graft (**f**, **g**), graft sutured to the recipient site (**h**), 2 weeks follow-up (**i**), 6 weeks follow-up (**j**)

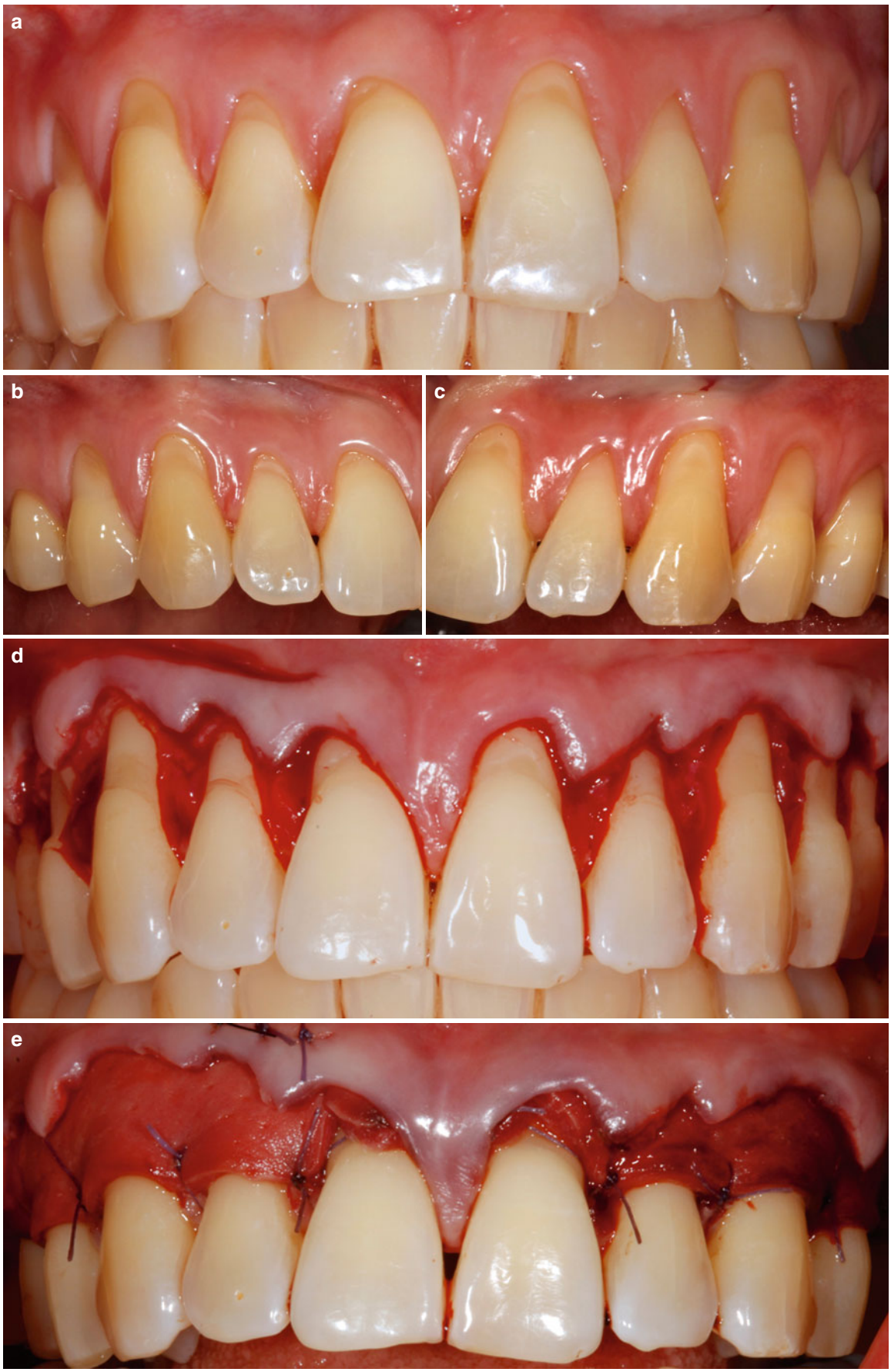
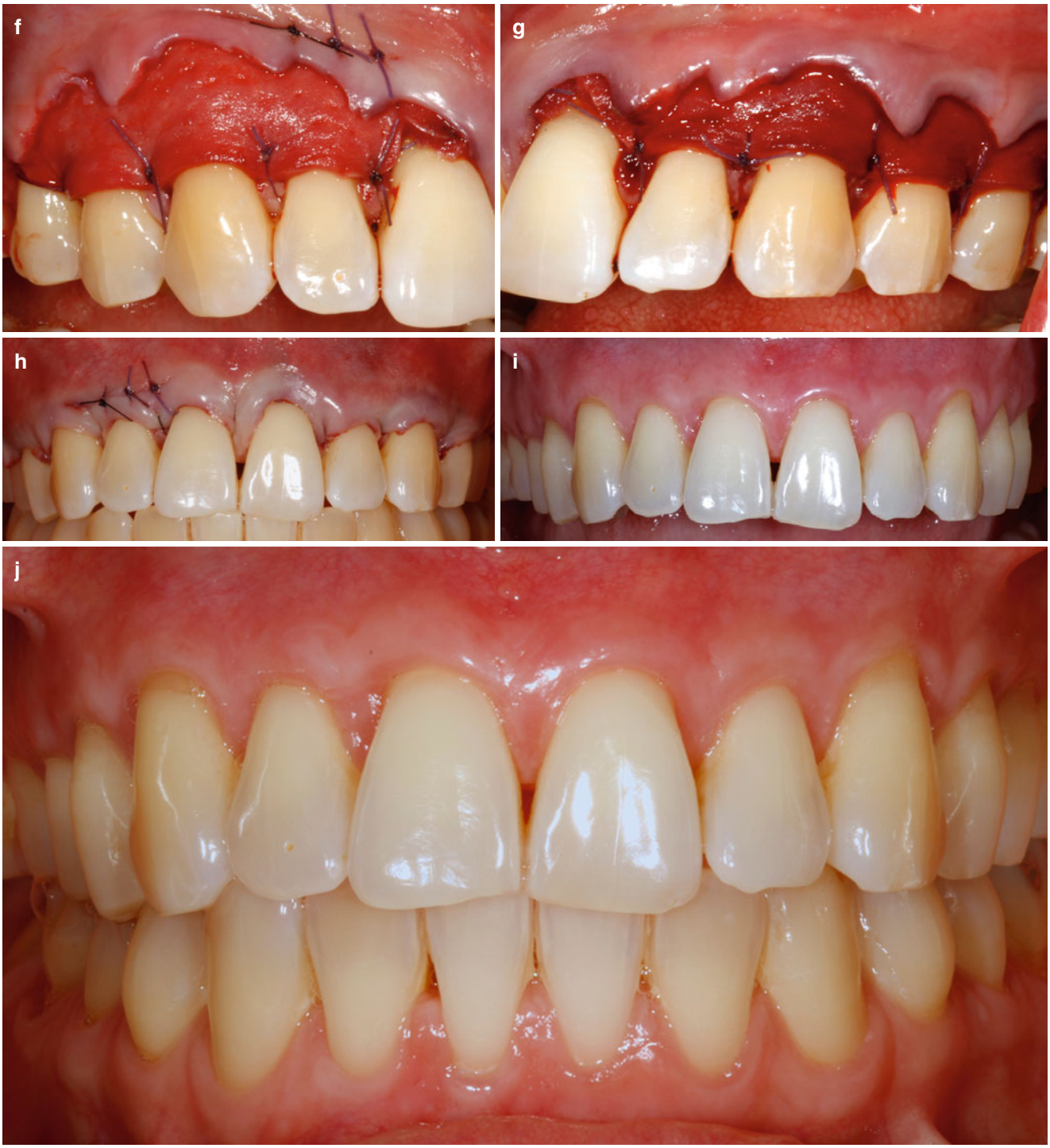


Fig. 4.16 (**a**–**e**) Case XII – Multiple class I and II recession-type defects on teeth 15, 14, 13, 12, 11, 21, 22, 23, 24, and 25 associated to noncarious cervical lesions treated with Puros Dermis®. Baseline (**a**–**c**), flaps raised (**d**). Grafts sutured (**e**–**g**) flaps coronally advanced and sutured covering completely the grafts (**h**) 6 months follow-up (**i**, **j**)



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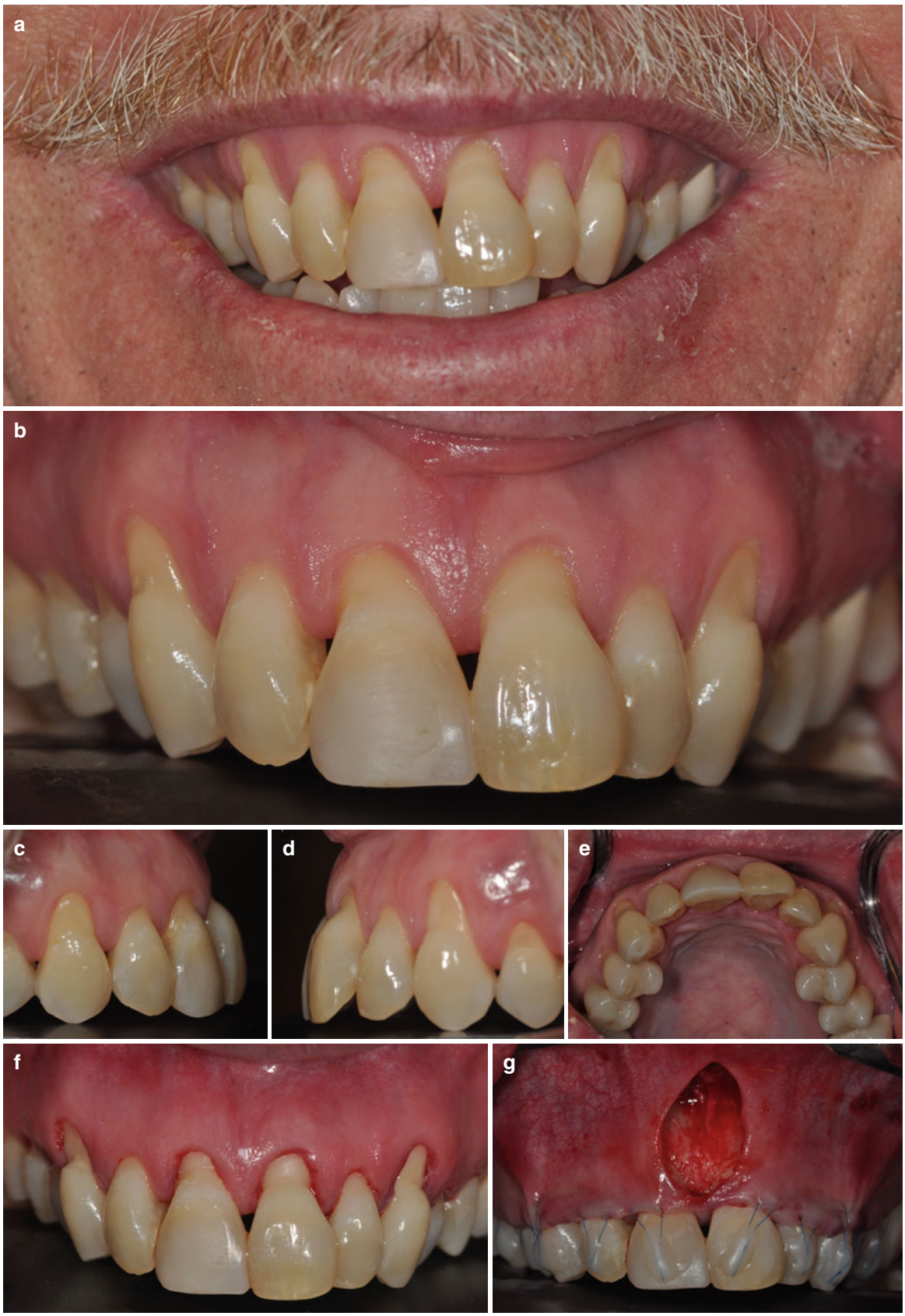

Fig. 4.17 (**a**–**j**) Case XIII – Multiple class I, II, and III recession-type defects on the anterior maxilla treated with Alloderm®. Baseline (**a**–**e**), recession after scaling of the exposed root surfaces (**f**), VISTA tunnel flap coronally advances and positioned with sutures and resin composites at each individual tooth presenting a gingival recession – note the vestibular incision used for graft positioning (**g**) grafts positioned via the tunnel flap and vertical incision suture (buccal frenulum) (H) clinical appeareance at the end of the procedure (**i**–**k**) 21 days follow-up – day of suture removal (**l**) 4 motnhs follow-up smile (**m**). This case was kindly provided by Prof. Homayoun Zadeh (the mentor of VISTA procedure)

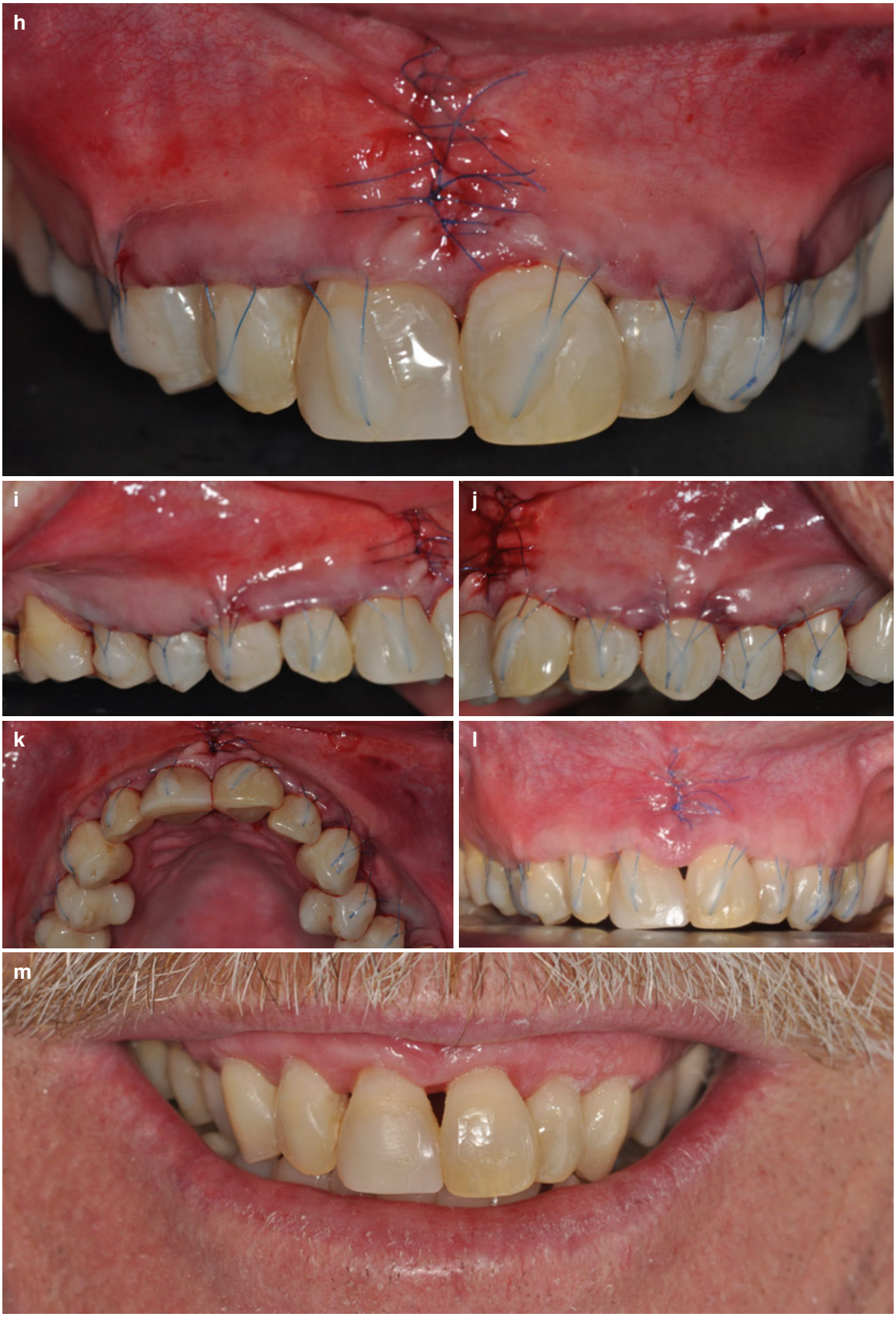

Fig. 4.17 (continued)

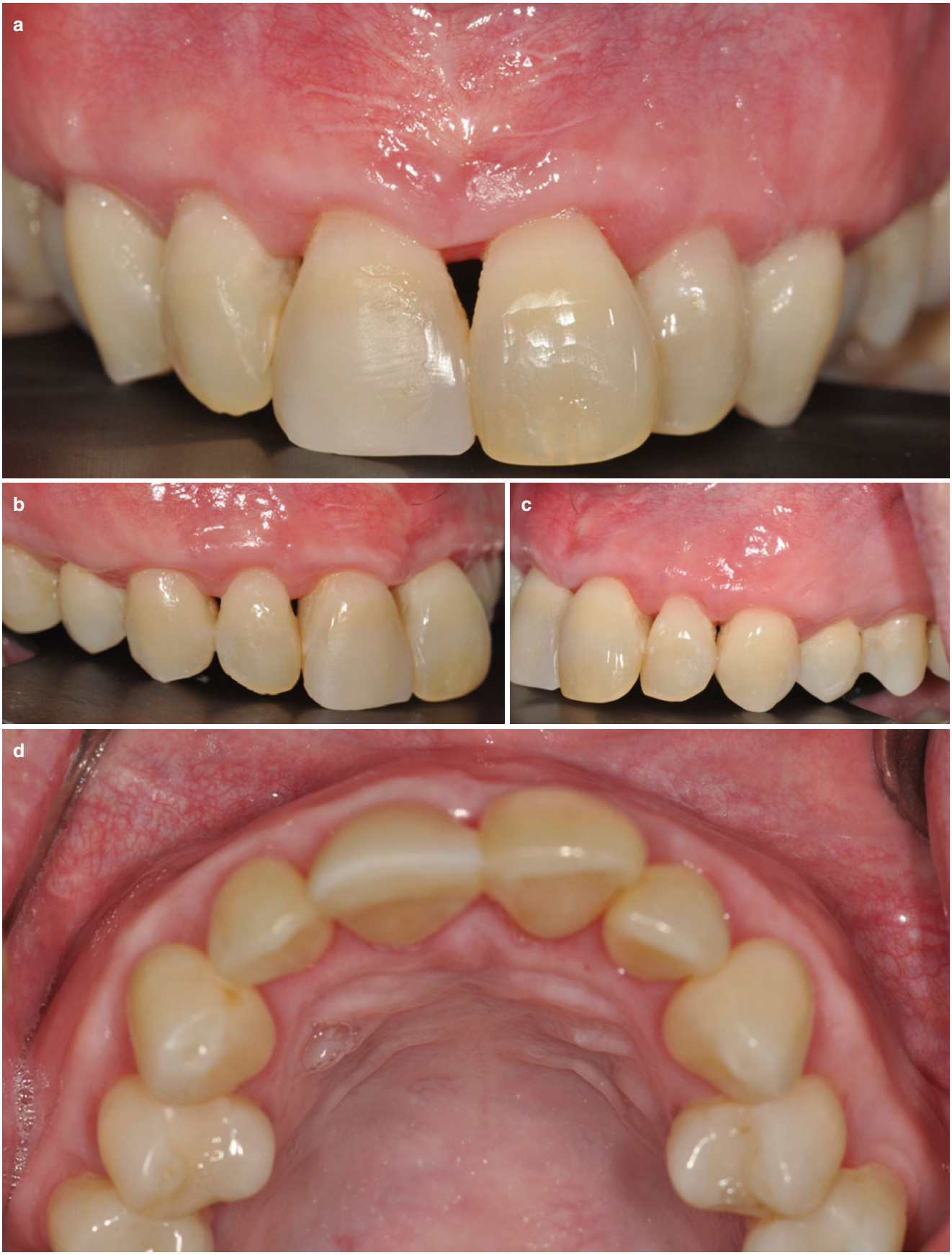

Fig. 4.18 Four months results (**a**–**d**)

References

1. Chambrone L, Chambrone D, Pustiglioni FE, Chambrone LA, Lima LA. Can subepithelial connective tissue grafts be considered the gold standard procedure in the treatment of Miller Class I and II recession-type defects? J Dent. 2008;36:659–71.
2. Chambrone L, Lima LA, Pustiglioni FE, Chambrone LA. Systematic review of periodontal plastic surgery in the treatment of multiple recession-type defects. J Can Dent Assoc. 2009;75:203a–f.
3. Chambrone L, Sukekava F, Araujo MG, Pustiglioni FE, Chambrone, LA, Lima LA. Root coverage procedures for the treatment of localised recession-type defects. Cochrane Database Syst Rev. 2009;(2):CD007161.
4. Chambrone L, Sukekava F, Araújo MG, Pustiglioni FE, Chambrone LA, Lima LA. Root coverage procedures for the treatment of localized recession-type defects: a Cochrane systematic review. J Periodontol. 2010;81:452–78.
5. Chambrone L, Faggion Jr CM, Pannuti CM, Chambrone LA. Evidence-based periodontal plastic surgery: an assessment of quality of systematic reviews in the treatment of recession-type defects. J Clin Periodontol. 2010;37:1110–8.
6. Chambrone L, Pannuti CM, Tu Y-K, Chambrone LA. Evidence-based periodontal plastic surgery. II. An individual data meta-analysis for evaluating factors in achieving complete root coverage. J Periodontol. 2012;83:477–90.
7. Chambrone L, Tatakis DN. Periodontal soft tissue root coverage procedures: a systematic review from the AAP Regeneration Workshop. J Periodontol 2015;86(2 Suppl):S8–51.
8. Griffin TJ, Cheung WS, Zavras AI, Damoulis PD. Postoperative complications following gingival augmentation procedures. J Periodontol. 2006;77:2070–9.
9. Harris RJ, Miller R, Miller LH, Harris C. Complications with surgical procedures utilizing connective tissue grafts: a follow-up of 500 consecutively treated cases. Int J Periodontics Restorative Dent. 2005;25:449–59.
10. Hokett SD, Peacock ME, Burns WT, Swiec GD, Cuenin MF. External root resorption following partial-thickness connective tissue graft placement: a case report. J Periodontol. 2002;73:334–9.
11. Carnio J, Camargo PM, Kenney EB. Root resorption associated with a subepithelial connective tissue graft for root coverage: clinical and histologic report of a case. Int J Periodontics Restorative Dent. 2003;23:391–8.
12. Corsair AJ, Iacono VJ, Moss SS. Exostosis following a subepithelial connective tissue graft. J Int Acad Periodontol. 2001;3:38–41.
13. Tatakis DN, Trobelli L. Adverse effects associated with a bioabsorbable guided tissue regeneration device in the treatment of human gingival recession defects. A clinicopathologic case report. J Periodontol. 1999;70:542–7.
14. Parashis AO, Tatakis DN. Subepithelial connective tissue graft for root coverage: a case report of an unusual late complication of epithelial origin. J Periodontol. 2007;78:2051–6.
15. Stafne EC, Gibilisco JA. Oral roentgenographic diagnosis. 4th ed. Philadelphia: W B Saunders Company; 1975. p. 189–91.
16. Chambrone LA, Chambrone L. Bone exostoses developed subsequent to free gingival grafts: case series. Br Dent J. 2005;199(3):146–9.
17. Douglas de Oliveira DW, Marques DP, Aguiar-Cantuária IC, Flecha OD, Gonçalves PF. Effect of surgical defect coverage on cervical dentin hypersensitivity and quality of life. J Periodontol. 2013;84:768–75.
18. Pini-Prato GP, Cairo F, Nieri M, Franceschi D, Rotundo R, Cortellini P. Coronally advanced flap versus connective tissue graft in the treatment of multiple gingival recessions: a split-mouth study with a 5-year follow-up. J Clin Periodontol. 2010;37:644–50.
19. Nieri M, Pini Prato GP, Giani M, Magnani N, Pagliaro U, Rotundo R. Patient perceptions of buccal gingival recessions and requests for treatment. J Clin Periodontol. 2013;40:707–12.
20. Rossberg M, Eickholz P, Raetzke P, Ratka-Krüger P. Long-term results of root coverage with connective tissue in the envelope technique: a report of 20 cases. Int J Periodontics Restorative Dent. 2008;28:19–27.
21. ADA Clinical Practice Guidelines Handbook [updated November 2013]. American Dental Association – available at: http://ebd.ada.org/contentdocs/ADA_Clinical_Practice_Guidelines_Handbook_-_2013_Update.pdf. Accessed 29 Jan 2014.
22. Aichelmann-Reidy ME, Yukna RA, Evans GH, Nasr HF, Mayer ET. Clinical evaluation of acellular allograft dermis for the treatment of human gingival recession. J Periodontol. 2001;72:998–1005.
23. Barros RR, Novaes Jr AB, Grisi MF, Souza SL, Taba MJ, Palioto DB. A 6-month comparative clinical study of a conventional and a new surgical approach for root coverage with acellular dermal matrix. J Periodontol. 2004;75:1350–6.
24. Novaes Jr AB, Grisi DC, Molina GO, Souza SL, Taba Jr M, Grisi MF. Comparative 6-month clinical study of a subepithelial connective tissue graft and acellular dermal matrix graft for the treatment of gingival recession. J Periodontol. 2001;72:1477–84.
25. Miller Jr PD. A classification of marginal tissue recession. Int J Periodontics Restorative Dent. 1985;5:9–13.
26. Thoma DS, Benić GI, Zwahlen M, Hämmerle CHF, Jung RE. A systematic review assessing soft tissue augmentation techniques. Clin Oral Implants Res. 2009;20 Suppl 4:146–65.
27. Kim D, Neiva R. Periodontal soft tissue non-root coverage procedures: a systematic review from the AAP regeneration workshop. J Periodontol 2015;86(2 Suppl):S56–72.
28. Chambrone LA, Chambrone L. Root coverage in a class IV recession defect achieved by creeping attachment: a case report. J Int Acad Periodontol. 2006;8:47–52.