
Esthetical Clinical Crown Lengthening, Lip Repositioning, and Gingival Depigmentation

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5.1 Esthetical Clinical Crown Lengthening

5.1.1 The Smile, My “Business Card”

For many people, the smile is considered the “business card” because it may reflect a part of the individual behavior and feeling of each one of us. Healthy, harmonious, and pleasant smiles are associated to four elements:

1. Smile line and its symmetry with facial structures: the human face presents anatomical structures that may guide the clinician during patient’s examination and decision-making process. The face may be divided in three thirds, where the mid and the lower are of more esthetical importance [1, 2]. The parallelism between the interpupillary, the ophriac (the line drawn over the eyebrows), the alar, and the commissural lines may assist the orientation of the incisal and occlusal planes and the gingival contours (these should be parallel to those facial lines) [1, 2]. The midfacial line (a line perpendicular to the interpupillary line) divides the face in two symmetrical parts, and this should be coincident to the midline of the dentition (this line also allows the assessment of contralateral teeth discrepancies related to size, shape, and axial inclination) [1, 2].
2. Soft tissue morphology and its contours around the six maxillary anterior teeth – the correct proportion of gingival line (i.e., the line joining the tangents of the gingival zeniths [the most apical aspect of the free gingival margin] of the central incisor and canine) [3–5].
3. Tooth morphology/proportions: the correct proportions of canines, lateral, and central incisions regarding its individual length and width (the tooth length/width ratio) [6, 7].
4. Osseous architecture (thickness/irregularities of the alveolar bone) and its location in relation to the cemento-enamel junction (i.e., 1–2 mm apically located) [6, 8].

5.1.2 “Pink” and “White” Esthetics: “Why Is It Important to Establish Balanced Proportions?”

Clinical crown lengthening procedures have long been used to reestablish the biological width of fractured/carious teeth [6, 9–11]. With the increasing demand for “pink” and “white” esthetics, treatment of anterior maxillary areas should encompass the functional and esthetical reestablishment of a balanced, healthy, and attractive smile. Nowadays, such objectives may be obtained via important changes

occurring in the fields of periodontology and restorative dentistry as reflected by their different esthetical/cosmetic approaches [12–16].

Within patients presenting completely erupted teeth and no history of tooth/gingival alterations (i.e., gingival recession, non-carious cervical lesions, caries, restorations, occlusal overload, soft tissue overgrowth, gingival inflammation, periodontitis, or previously submitted to periodontal surgical procedure) the gingival zenith of the canines seems to be located apically to the gingival zenith of the incisors; however, the gingival zenith of the lateral incisors may be located below (for almost 80 % of all subjects) or on the gingival line [5]. Moreover, it has been demonstrated that the gingival zeniths of all maxillary anterior teeth are not completely displaced toward the distal aspect, that is, “the more anterior the tooth, the greater the prevalence and distal displacement of the gingival zenith” [17].

On the other hand, altered passive eruption (a tooth exposure secondary to apical migration of the gingiva [18]) may cause excessive gingival display upon smiling and overlapping of portions of the anatomical crown by the soft tissues [8, 13, 15]. As a result, the negative imbalance between the amount of soft tissue and the shortened length of the clinical crowns may alter the smiles’ esthetic appearance. With respect to passive eruption of the “dentogingival junction” in adults, this can be assessed based on two anatomic relationships [8]:

- Gingiva–anatomic crown relationship (Fig. 5.1) – this can be divided in type I (where the gingival margin is located incisal to the cemento-enamel junction and the gingival dimension is prominently wider from the margin to the mucogingival junction) or type II (normal dimension of the gingival margin to the mucogingival junction) [8].
- Alveolar crest–cemento-enamel junction relationship (Fig. 5.2) – this can be divided in subtype A (where the distance between these structures is around 1.5 mm, and a normal attachment of gingival fibers into the cementum is observed) or subtype B (both structures are at the same level) [8].

In addition, the knowledge on the anatomical characteristics of periodontal tissues of maxillary anterior teeth (i.e., gingival zenith and location of the alveolar bone crest with respect to the cemento-enamel junction) and smile line/facial structures may be used clinically to determine the ideal unilateral positioning of the gingival margin during periodontal surgical treatment alone or in combination with multidisciplinary approaches involving orthodontic and prosthetic therapies [17].

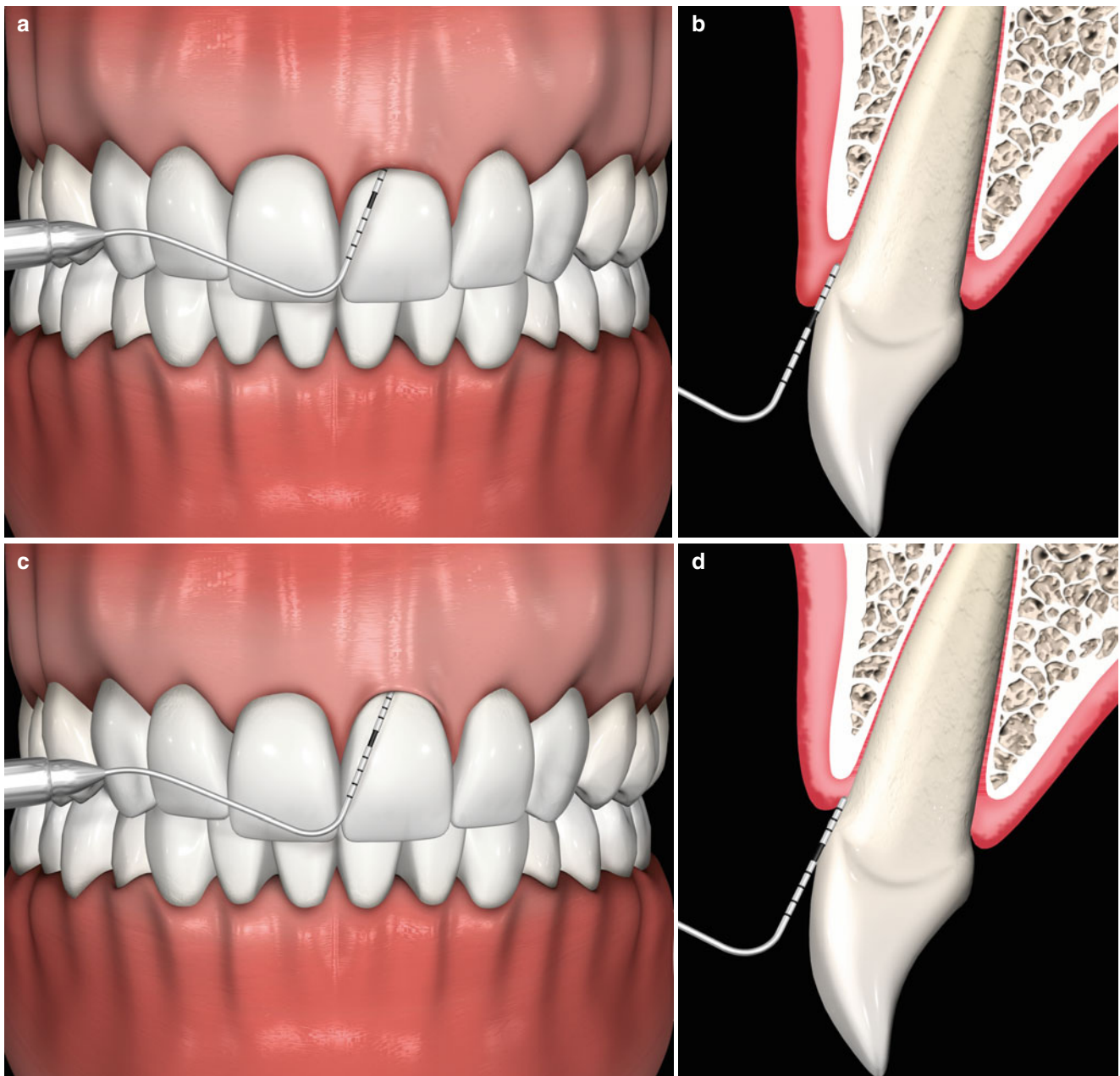


Fig. 5.1 Gingiva–anatomic crown relationship. Type I – the gingival margin is located incisal to the cemento-enamel junction, and the gingival dimension is prominently wider from the margin to the mucogingi-

val junction (a, b). Type II – normal dimension of the gingival margin to the mucogingival junction (c, d)

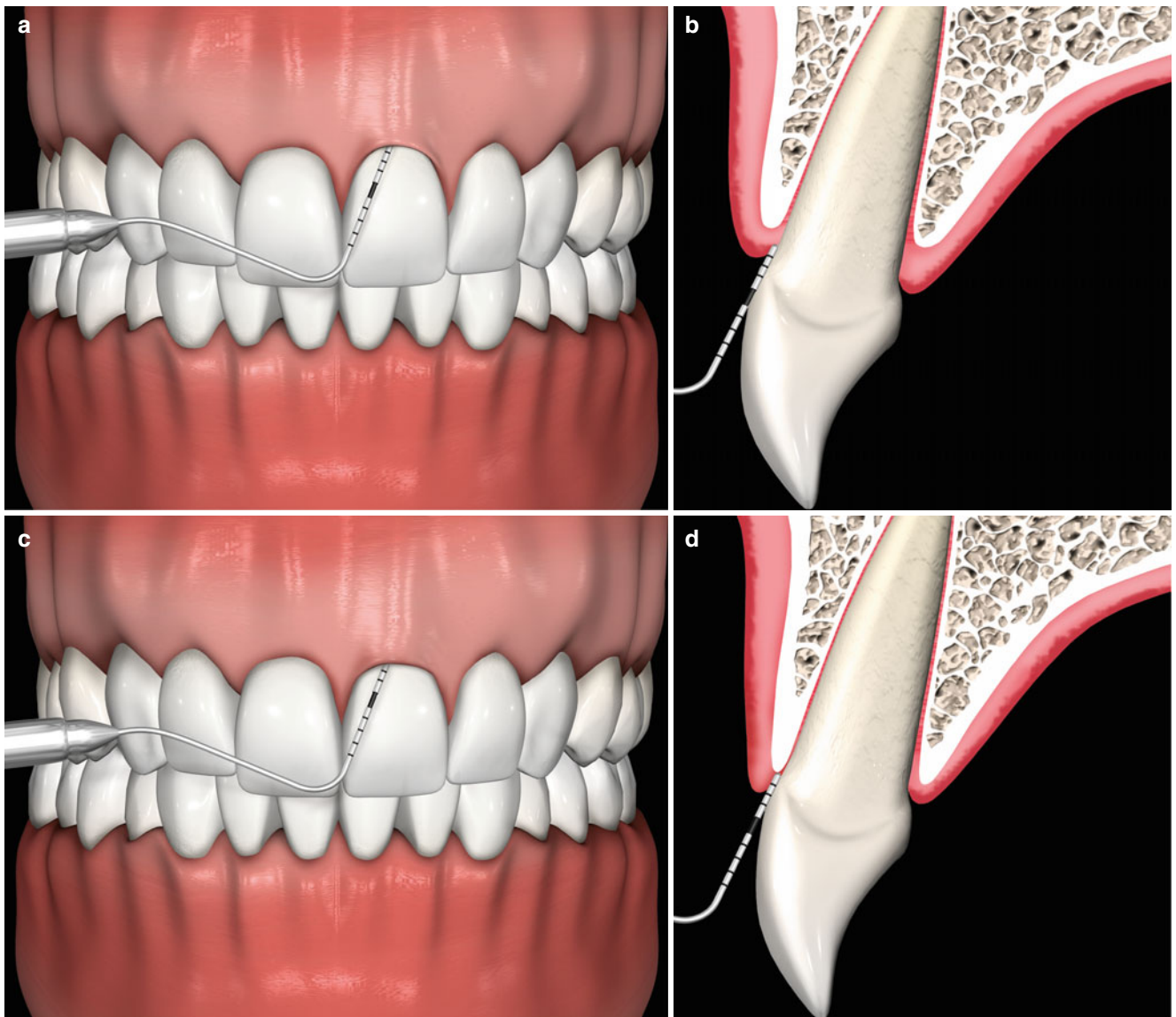


Fig. 5.2 (a–d) Alveolar crest–cementoenamel junction relationship. Subtype A – the distance between these structures is around 1.5 mm, and a normal attachment of gingival fibers into the cementum is observed (a, b). Subtype B – both structures are at the same level (c, d)

5.1.3 Esthetical Clinical Crown Lengthening: “What May Be Expected After the Use of Periodontal Plastic Surgery Procedures?”

Despite being considered of more esthetic than of functional concerns, it has been demonstrated that an excessive gingival display (or gummy smile) may have a detrimental impact on the opinion of “a patient’s attractiveness, friendliness, trustworthiness, intelligence, and self-confidence” [14].

Descriptions of the use and outcomes of clinical lengthening procedures for the correction of anatomical discrepancies of the gingival and osseous architectures (e.g., altered dental eruption), gummy smile, and prior to prosthetic restorations may be found in the literature, and these approaches have encompassed the use of periodontal surgical techniques alone or in association to restorative procedures:

- Pontoriero and Carnevale [9] evaluated the stability of the marginal periodontal tissues up to 12 months following surgical crown lengthening performed at the anterior and posterior teeth. A mean gingival coronal displacement of the gingival margin of 1.2 mm was found at buccal/lingual sites and 0.5 mm at interproximal sites from the end of the surgical procedure to the last follow-up – this outcome seemed associated to thick periodontal biotypes.
- Lanning et al. [10] observed that the biological width is reestablished to its original dimension 6 months after surgery, as well as when the amount of bone to be removed is based on the future margins of the restoration and the original length of the biological width – definitive restorations may be performed 3 months after treatment (even in esthetic areas).
- Deas et al. [11] also observed a significant gingival rebound of 30.8 % of gain of crown height achieved with surgical procedure, 6 months following treatment, related to the flap position over the alveolar bone crest at suturing.
- Perez et al. [19], in contrast to Deas et al. [11], demonstrated that following a 6-month healing period, the supracrestal gingival unit (i.e., biologic width) of buccal sites was reduced by 14.1 %.
- Joly et al. [12] described a minimally invasive flapless approach valid for patients presenting a wide band of keratinized tissue and thin bone (i.e., patients with a thin or intermediate biotypes).

5.1.4 Type of Defect/Condition to Be Indicated

Treatment of patients with high smile line (gummy smile) or with discrepancies in the gingival margin (zenith) of anterior teeth that may impact the patient’s esthetics (i.e., patient’s personal report describing a deteriorated esthetic appearance due to its “gingival smile”)

5.1.5 Type of Defect Not to Be Indicated

Exposure of no more than 2 mm of gingival tissue during a natural smile (i.e., medium or low smile line) and in areas where the stability of the dentition may be compromised

5.1.6 Basics of the Surgical Sequence

For the flapless esthetic clinical crown lengthening procedure [12], an adequate band of keratinized tissue and a thin bone should be present. In this procedure, sulcular or inverted beveled incisions are performed on the anterior teeth requiring crown lengthening based on the amount of bone/soft tissue to be removed and the new position of the gingival margin established (in relation to the cemento-enamel junction). This may be facilitated with the assistance of a diagnostic wax-up, a clinical mock-up, and an acrylic individual surgical guide since it assists the picturing of the future position of gingival margins and restorations’ shape (when indicated). These steps permit a more accurate, predictable, and less traumatic/invasive surgical procedure. After that, the collars of gingiva should be removed, and osseous remodeling takes place via “gingival sulcus” using micro-chisels, and no suture procedures are required (Fig. 5.3).

With respect to the conventional surgical procedure, full-thickness flap rising should be performed after the removal of soft tissue collar. Osseous resection may be carried out using chisels or rotatory instruments with carbide burs, and the flap is positioned at the level or apical to cemento-enamel junction (based on the periodontal/restorative treatment proposed) and sutured by 5-0 or 6-0 nylon/Teflon sutures (Fig. 5.4). The sutures are removed 14 days after surgery. In addition, patients should be instructed not to brush the teeth in the treated area, as well as they are prescribed 0.12 % chlorhexidine gluconate and instructed to rinse gently twice a day for 2–3 weeks, or until safe and comfortable toothbrushing can be performed. Overall, like all other periodontal plastic surgery procedures, analgesics, anti-inflammatory drugs, and/or systemic antibiotics are prescribed if needed, as well as no adverse effects are expected in the treated sites.



Fig. 5.3 (a–e) Esthetic clinical crown lengthening – flapless procedures [12], baseline (a), clinical mock-up positioned determining the future gingival margin and guiding the external beveled incisions (b), removal of gingival collars (c), osteotomy via the gingival sulcus (d), no sutures are performed (e)

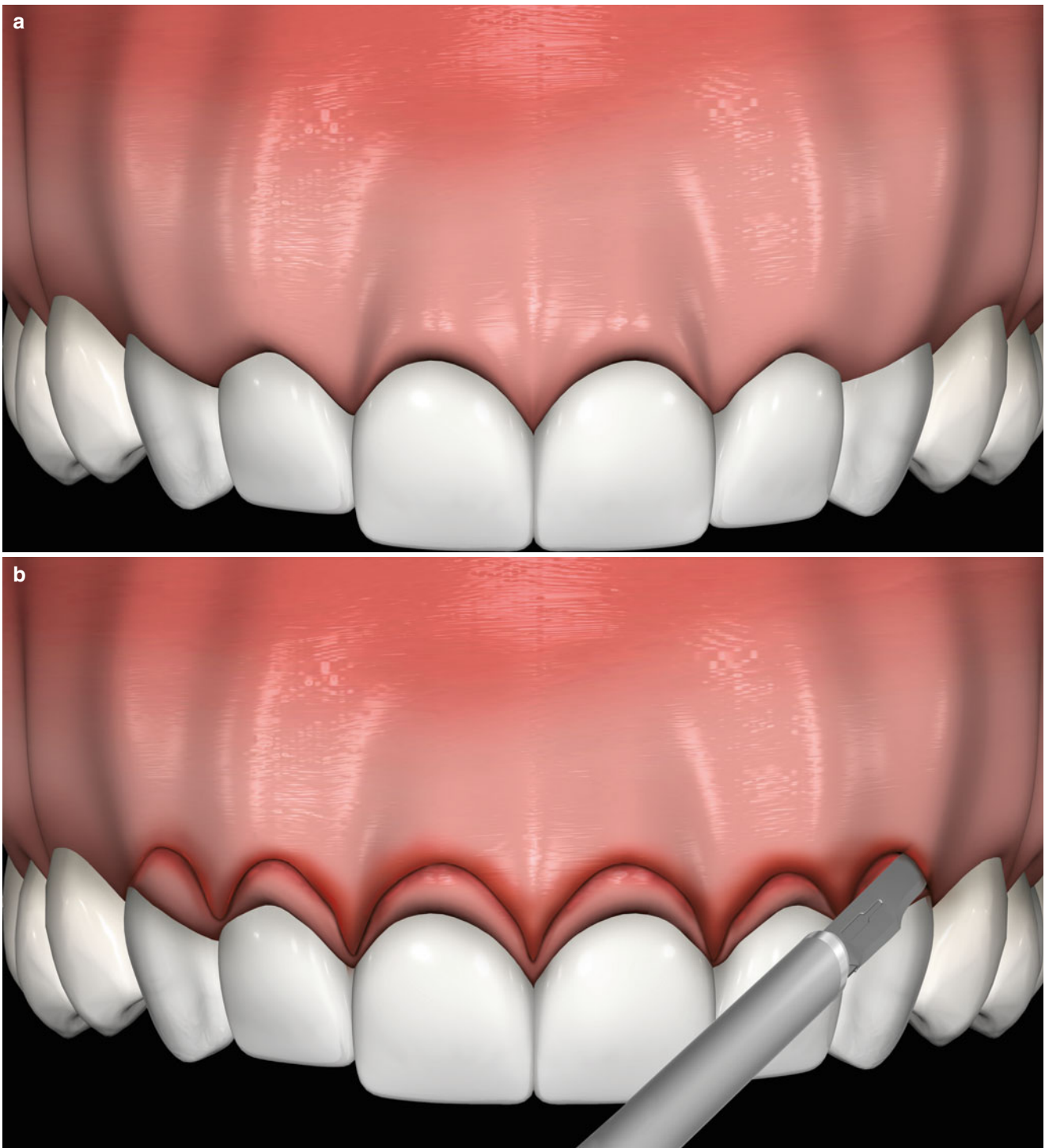


Fig. 5.4 (a–h) Baseline (a), external beveled incision (b) Intrasulcular incisions (c). Gingival collar removal (d). Full-thickness flap raised (e). Osteotomy and osteoplasty (f). Checking the distance of the alveolar crest to the cemento-enamel junction (g). Flap positioned and sutures apically (h)

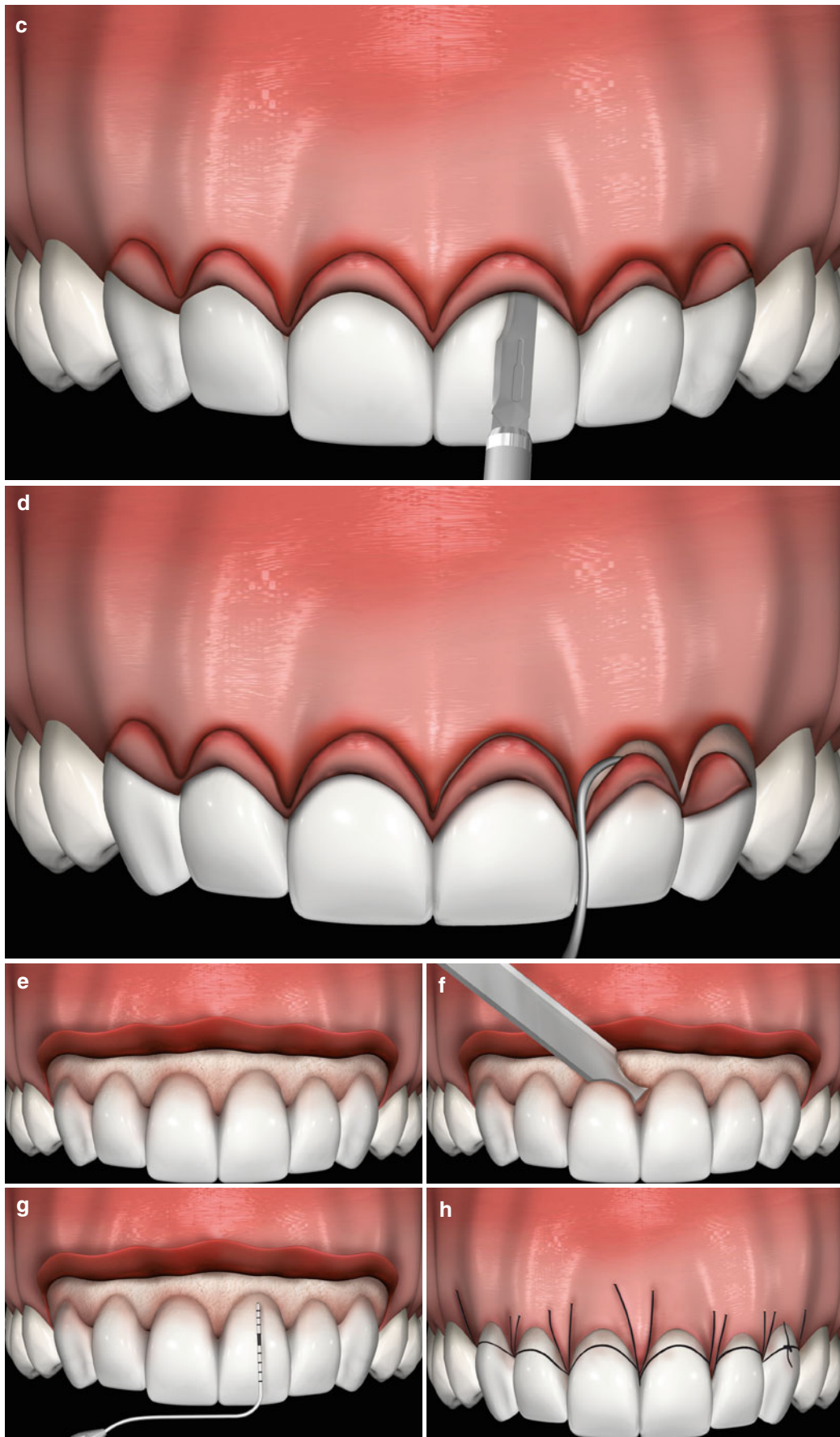


Fig. 5.4 (continued)

5.1.7 Orthodontic Tooth Extrusion: “Can Orthodontics Act as a Coadjuvant to the Use of Periodontal Plastic Surgery Procedure?”

Orthodontic extrusion associated with periodontal flap surgery or fiberotomy, during or immediately after extrusion, may be considered an additional resource for single tooth

requiring esthetical clinical crown lengthening [20]. Fiberotomy has the advantage of preventing the return of the dental structure to its original position or the concomitant extrusion of both soft and hard tissues, which may lead to the need of additional plastic periodontal surgical procedures [20]. However, in sites lacking interpapillary gingiva, orthodontic extrusion without fiberotomy may provide superior esthetical gains (Figs. 5.5 and 5.6).

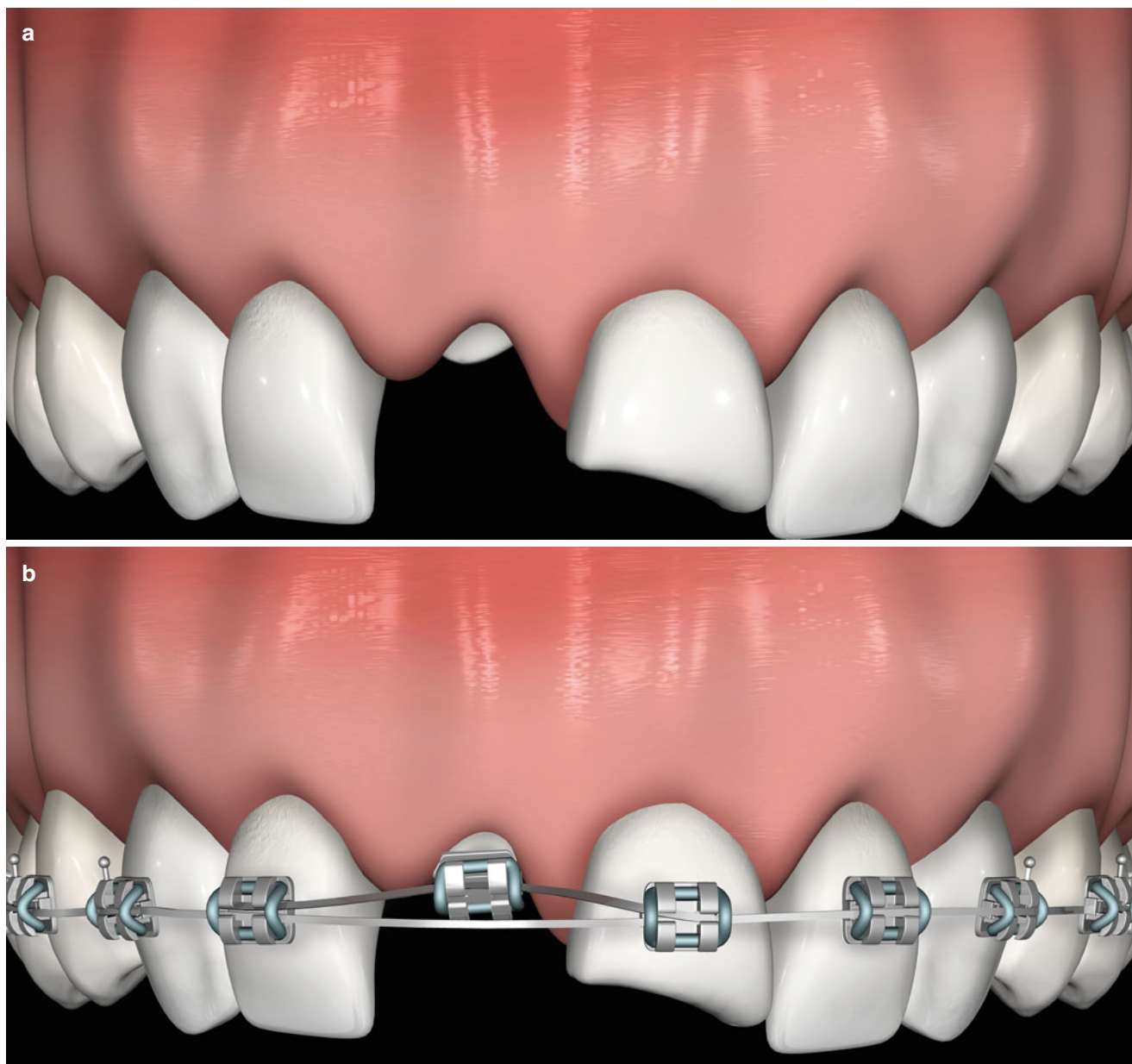


Fig. 5.5 Orthodontic tooth extrusion associated to fiberotomy in esthetic areas. Baseline – one or more teeth presenting fractures or caries invading the biological width (a). Use of partial fixed orthodontic appliance – passive bonding (in the same horizontal plane) of 0.022-in. brackets from the first right bicuspid to the first left bicuspid (on the

tooth to be extruded, the bracket is positioned more apically to provide an extrusive component), placement of a 0.014-in. nickel–titanium arch wire and a 0.019×0.025 in. stainless steel auxiliary arch used to stabilize the segmented wire (b)

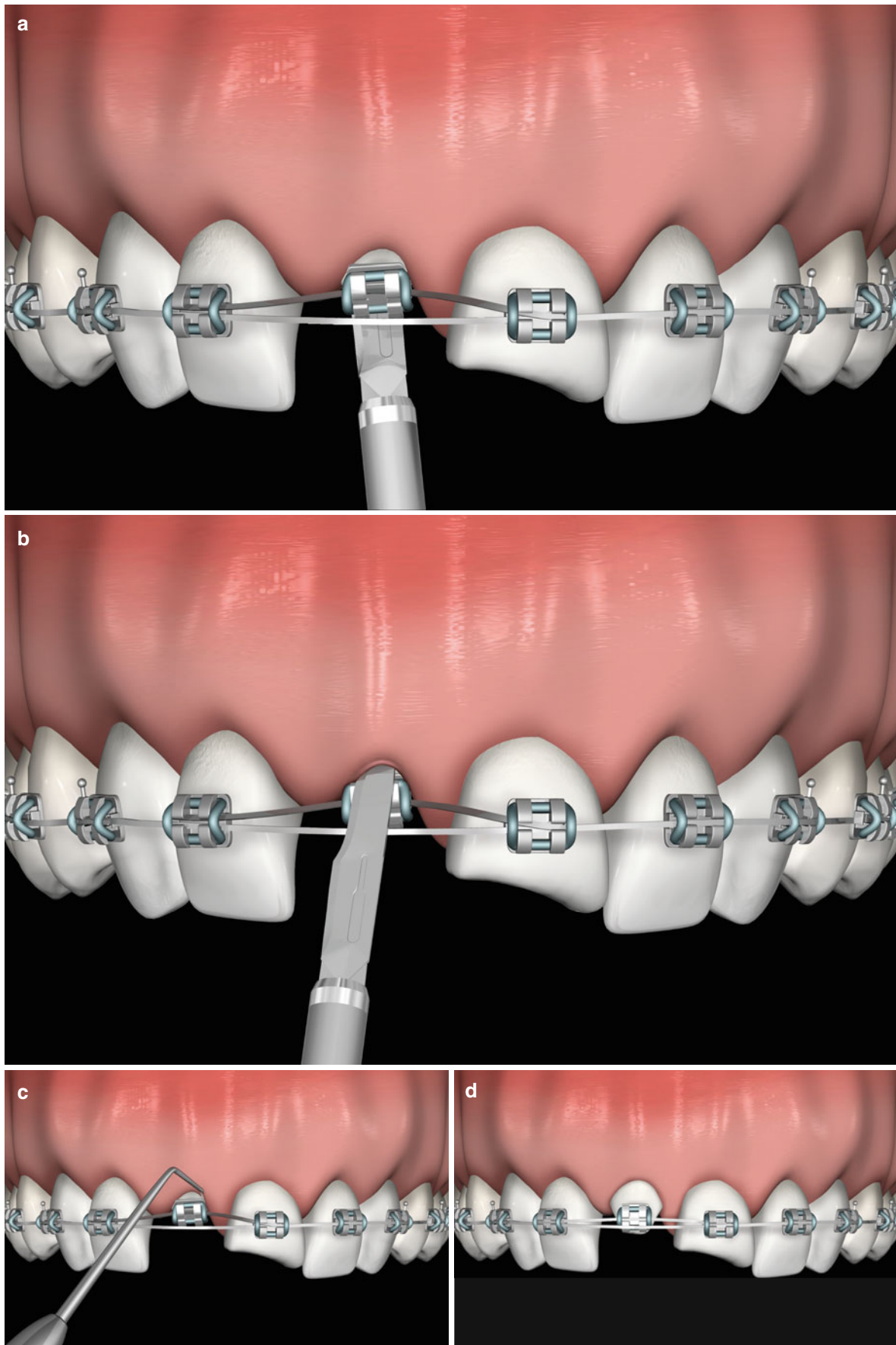


Fig. 5.6 Palatal intrasulcular incision (a). Buccal intra sulcular incision (b). Scaling and removal of supracrestal gingival fibers (c). Orthodontic extrusion without changes in the gingival margin (d)

5.1.8 Clinical Remarks: Implications for Practice and Clinical Decision-Making on Esthetical Clinical Crown Lengthening

Most of the data on crown lengthening procedures regard to studies on teeth requiring restorative approaches. Indeed, just one randomized trial on the treatment of anterior teeth exclusively due to esthetical purposes (on multiple teeth) was published up to now [13]. Overall, the outcomes accomplished by the use of esthetical clinical crown lengthening procedures, in clinical terms, may improve patients' esthetics because of the harmonization of the gingival tissues and teeth and the concomitant improved balance between lips, gingiva, and facial profiles [13]. These favorable conditions will result in more stable outcomes that may be maintained for long-term periods when the patients' full-mouth plaque score is less than 20 % [16].

The use of flapless approaches may decrease gingival height and volume, as well as lead to a minimal injury to the blood vessels and tissues, a reduced surgical morbidity, a more uniform healing process, and prevent the formation of scars [12, 13, 16]. Additionally, multidisciplinary treatment plans based on a diagnostic wax-up and a mock-up may guide the surgical procedure, reduce the gingival trauma, and assist posterior prosthetic treatment planning with restorative/prosthetic laminate veneers or full crowns. For such cases, the locations of the future biological width should be anticipated. However, information on the long-term maintenance of results have not been established yet, thus the potential of tissue regrowth (specially within patients presenting a thick periodontal biotype) should be assessed during wound healing in order to establish the best time for the subsequent definitive restorative treatment when intrasulcular prosthetic margins are planned to complete the case [9, 11].

Additionally, when multidisciplinary approaches were indicated for teeth presenting color alterations, shape deformities, irregular positioning in the dental arch, inadequate contact points, cervical lesions, and excessive occlusal wear,

these should be carefully planned. The establishment of a proper crown length/width ratio may improve the outcomes of surgical procedure (i.e., central incisors > canines > lateral incisors) as it may provide an improved balance between teeth and gingiva during a smile (a better distribution of the six teeth of the anterior maxillary sextant) [7]. Within treatment planning involving ceramic crowns or laminated veneers, these should present smooth and precise margins located no more than 0.5 mm into the gingival sulcus, as well as a minimum of 3 mm distance of the margins of the restorations to the alveolar bone crest should be respected to prevent gingival inflammation and periodontal attachment loss [22, 23]. Provisional dental preparations and restorations (for porcelain veneers or full crowns) may be performed approximately 30 days after surgery, whereas definitive prosthetic restorations may be fabricated after full healing of periodontal tissue (i.e., 6 months postsurgery) [6]. As a general rule, the stability of the soft tissues surrounding ceramic crowns or laminated veneers will be directly linked to the health of periodontal tissues (e.g., lack of plaque-induced periodontal diseases), to the minimum trauma during intrasulcular margin placement and gingival displacement procedures, to the quality of provisional restorations, to the complete removal of excess of temporary and final cements, and the wait for the proper follow-up healing period after surgery before installing the definitive restorations [22].

Finally, the orthodontic extrusion may improve the esthetic crown lengthening as well. It should be performed based on clinical and radiographic data obtained at initial examinations, as well as it should be kept in mind that these may not provide an exact measurement of the amount of tooth/root to be extruded. When orthodontic extrusion was associated to circumferential fiberotomy, it does not lead to significant changes in the gingival and osseous tissues' anatomy. Conversely, conventional orthodontic extrusion (without fiberotomy) may improve the amount of soft tissue in interproximal areas and favor the achievement of better gingival contours when associated to crown lengthening surgery (Figs. 5.7, 5.8, 5.9, 5.10, 5.11, 5.12, 5.13, and 5.14).

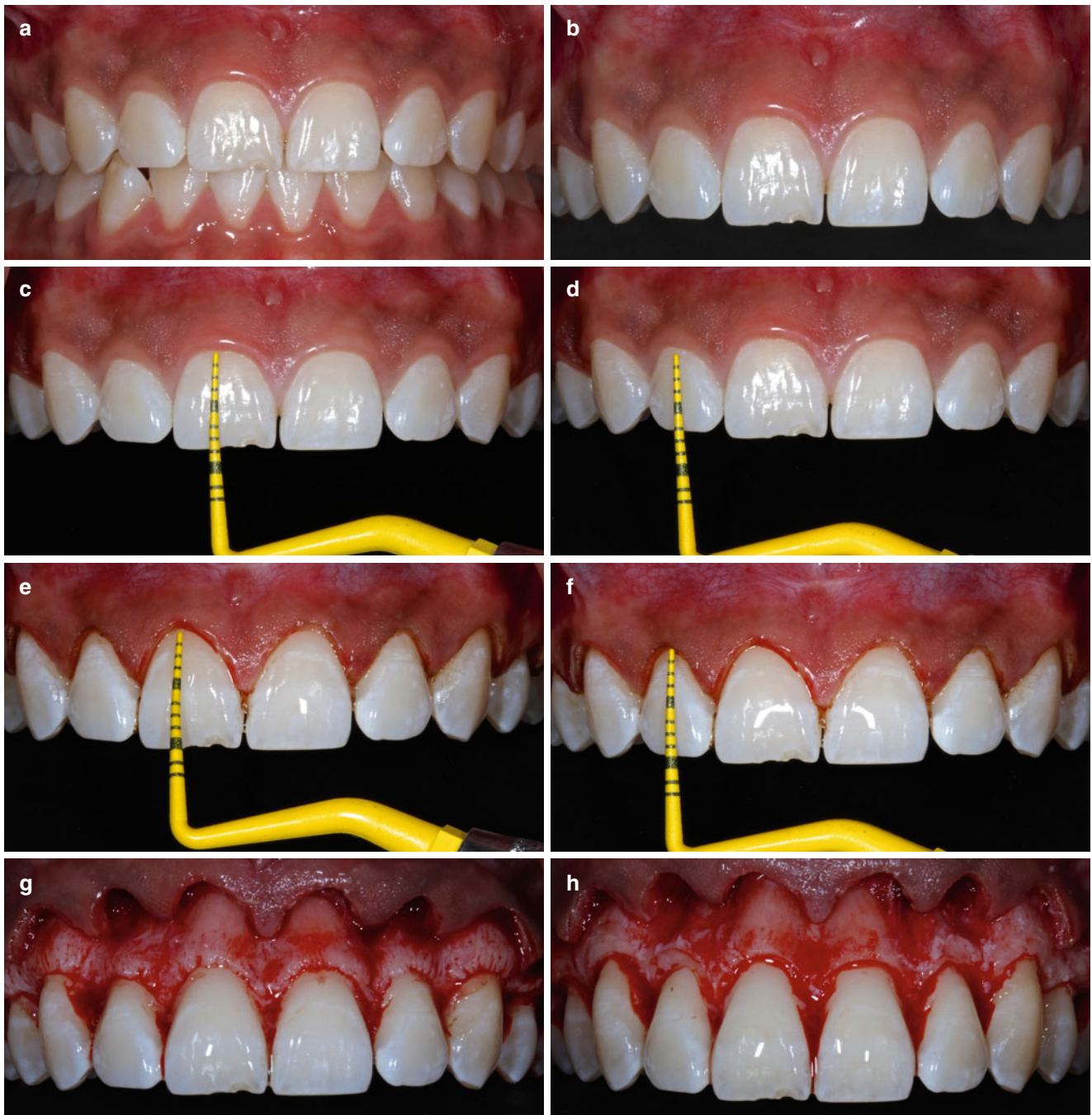


Fig. 5.7 Case I – 8 (a–n) Esthetic clinical crown lengthening of maxillary anterior segment. Baseline – gingiva–anatomic crown relationship type I (a, b). Checking crown length on central incisors (c). Checking crown length of lateral incisor (d). Rechecking of clinical length of central incisors after removal of gingival collar (e). Rechecking of clinical

length of lateral incisors after removal of gingival collar (f), alveolar crest–cemento enamel junction relationship subtype B (g). Osseous contour after osteotomy and osteoplasty procedures (h). Flap positioned and sutured apically (i). Flap positioned and sutured apically (j). Smile appearance before (k) and after treatment (l) 3 months follow-up (m, n)



Fig. 5.7 (continued)



Fig. 5.8 Case II (a–l) Esthetical clinical crown lengthening of maxillary anterior segment. Baseline – gingiva–anatomic crown relationship type I (a, b). Osseous contour before osteotomy and osteoplasty procedures (c). Alveolar crest–cemento-enamel junction relationship subtype B (d). Osseous contour after osteotomy and osteoplasty procedures (e).

Change of alveolar crest–cemento-enamel junction relationship to subtype A (f). Two weeks follow-up – immediately after suture removal (g). Three months follow-up (h). Baseline smile appearance (i). Final smile appearance (j). Gingival anatomy adjacent to upper incisors at 4 months follow-up (k), 4 months follow-up (l)



Fig. 5.8 (continued)



Fig. 5.9 Case III 10 (a–j) – Esthetic clinical crown lengthening of maxillary anterior segment. Baseline – gingiva–anatomic crown relationship type I (a, b). Incisions performed and gingival collar delimited (c). Clinical aspect during osteotomy and osteoplasty procedures (d).

Flap positioned and sutured apically (e). Flap positioned and sutured apically (f). Smile appearance before surgery (g). Smile appearance after surgery – last follow-up (h). Four months follow-up (i, j)



Fig. 5.10 Case IV 11 (a–h) – Esthetical clinical crown lengthening of maxillary anterior segment. Baseline (a). After intrasulcular incision – no internal beveled incision was performed (b). Osseous contour at the

central incisors (c). Osseous contour at the left lateral incisor (d). Osseous contour at the right lateral incisor (e). Flap sutured (f). Three months follow-up (g, h)



Fig. 5.11 Case V – Esthetic clinical crown lengthening of maxillary anterior segment. Baseline (a). Osseous contour after osteotomy and osteoplasty (b). Flap positioned and sutured apically (c). Fifteen days follow-up (d). Three months follow-up (e). Six months follow-up (f–h)



Fig. 5.12 Case VI – Esthetical clinical crown lengthening of maxillary incisors, baseline (a, b). Gingival collar delimited by the incisions (c). Gingival collar removed (d). Osseous contour before osteotomy and

osteoplasty procedures (e). Osseous contour after osteotomy and osteoplasty procedures (f). Flap apically positioned and sutured (g). Fifteen days follow-up (h). Smile appearance 3 months after surgery (i)



Fig. 5.13 Case VIII 14 (a-l) – Esthetical clinical crown lengthening of anterior maxillary teeth (a). Crown length: right canine (b); right lateral incisor (c), right central incisor (d), left central incisor (e), left lateral incisor and (f) left canine (g). Flap positioned and sutured apically (h), 6 weeks follow-up (i-k), 5 years follow-up (l)

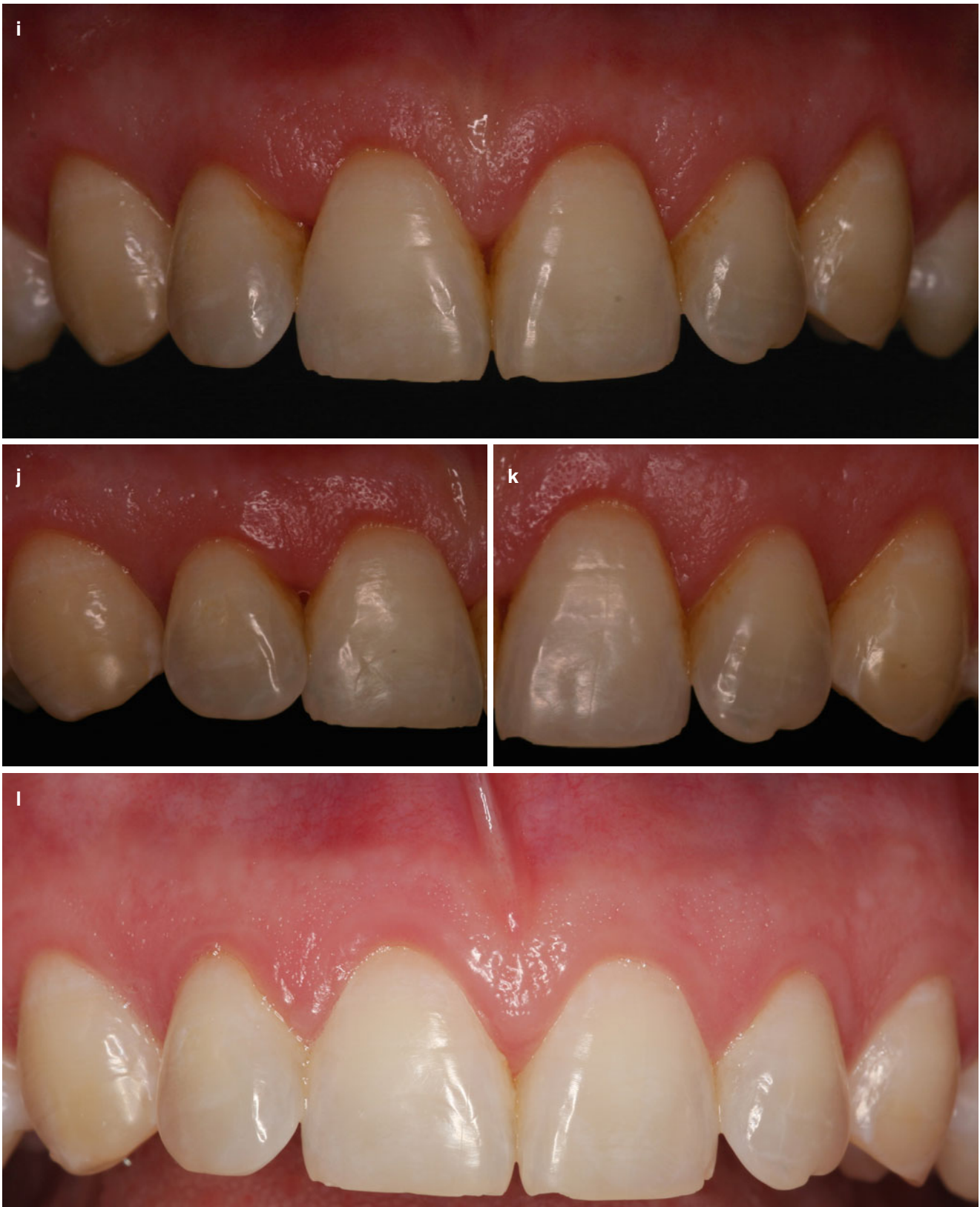


Fig. 5.13 (continued)



Fig. 5.14 Case VIII – Esthetical clinical crown lengthening of anterior teeth to the end of orthodontic treatment. Gingiva–anatomic crown relationship type I (a). Estimation of the amount of soft tissue overgrowth formed (b). Inadequate gingival contour (c). Assessment of the amount of soft tissue to be removed (d). Amount of soft tissue removed with gingi-

vectomy – external beveled incision (e). Clinical aspect after gingivectomy (f). Gingival contour after osteotomy and osteoplasty (g). One month follow-up (h). Before gingivectomy with external beveled incision (i) one week follow-up (j), 15 days follow up - lower arch (k), baseline smile (l), 45 days follow-up (m, n), 15 days follow-up (o)

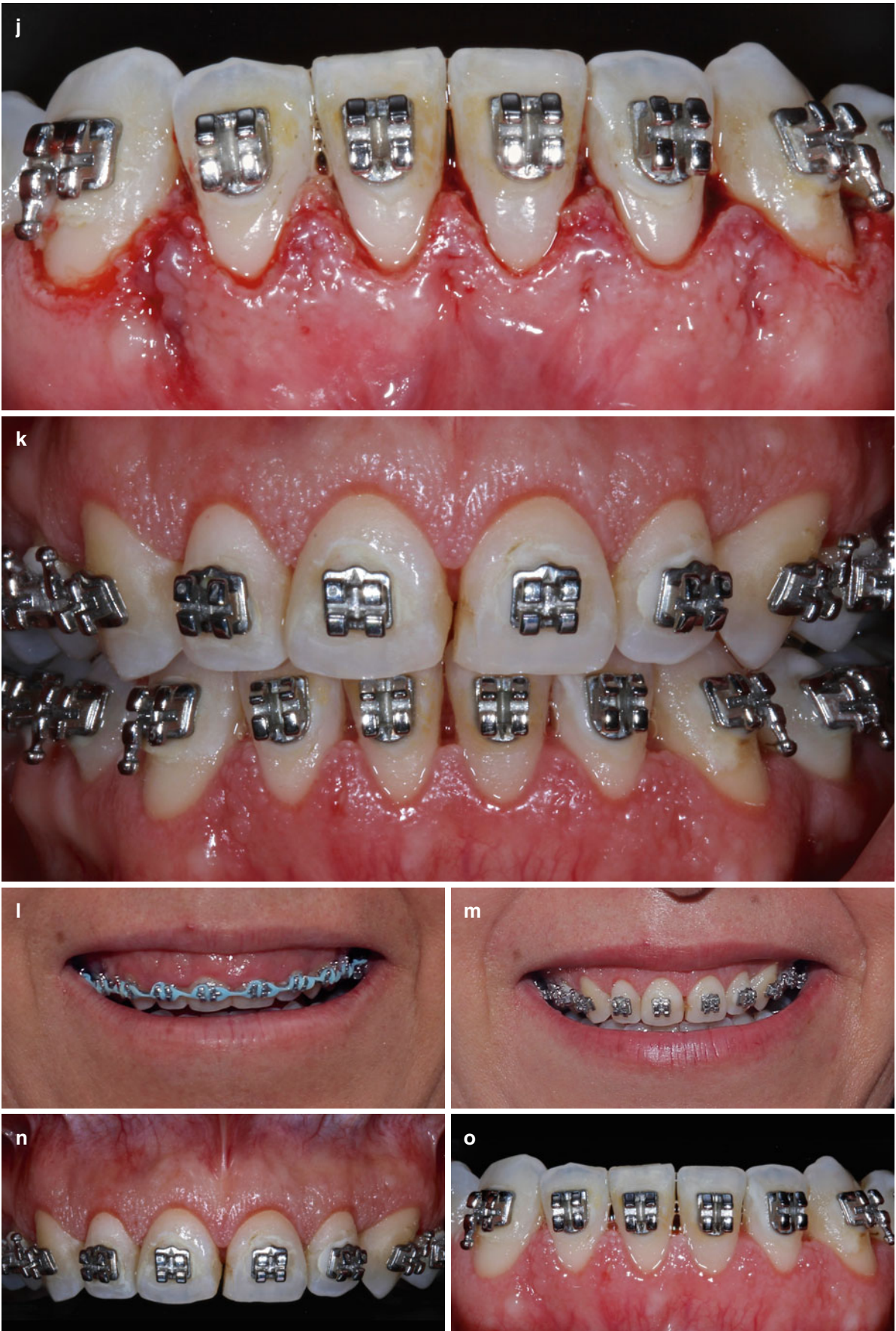


Fig. 5.14 (continued)

Critical Summary of the Results of Systematic Reviews

Systematic review conclusions: There is no information of systematic reviews concerning the use/effects of esthetic clinical lengthening procedures.

Summary of the review and critical remarks: Most of the literature on this topic is derived from case reports/series [12, 16]. In fact, only one randomized clinical trial is reported in the base of evidence:

Ribeiro et al. [13] – The use of open flap or flapless procedures for esthetic clinical crown lengthening provided similar and stable clinical outcomes 12 months postsurgery.

Evidence quality rating/strength of recommendation (ADA 2013) [21]: Expert opinion for – the single RCT available favors providing this intervention, but evidence is lacking, and expert opinion guides this recommendation.

5.2 Lip Repositioning

5.2.1 Historical Notes and Introductory Remarks

Several periodontal, restorative, and maxillofacial procedures have been associated to the treatment of excessive gingival display or “gummy smile” based on the etiologic origin of the condition [24]:

- Delayed tooth eruption – treatment is based on crown lengthening procedures such as gingivectomy and apically positioned flap associated to osteotomy/osteoplasty. [24]
- Compensatory tooth eruption of the upper incisors and canines due to excessive incisal wear/attrition associated to coronal migration of the soft and hard periodontal tissues – improvements in the smile may be achieved by orthodontic intrusion of the upper anterior teeth [24].
- Excessive vertical growth of the maxilla leading to an enlargement of the vertical dimensions of the mid face – usually, treatment involves orthognathic surgery via maxillary impaction (Le Fort I osteotomy) [24].
- Maxillary lip moving in an apical direction upon smile that leads to upper teeth exposure and excessive gingival display – achievement of a normal gingival display may be achieved by lip reposition surgery [24].

With respect to the last etiologic origin, the use of lip repositioning techniques was first described in 1973 by Rubinstein and Kostianovsky [25]. This procedure is based on the removal of a mucosal strip from the upper buccal vestibule in order to limit the retraction of the upper lip elevator muscles, such as the *levator labii superioris*, *levator anguli oris*, *orbicularis oris*, and the *zygomaticus minor* [26]. The clinical application of this plastic approach as part of peri-

odontal treatment has been recently described in the literature mostly by series of case reports and case series [1, 24, 26–30].

5.2.2 Type of Condition to Be Indicated

Excessive gingival display caused by hyperactive upper lip moving

5.2.3 Type of Condition Not to Be Indicated

Presence of a narrow width of keratinized attached gingiva or excessive vertical growth of the maxilla. The use of this procedure in patients lacking attached gingiva may create a shallower and narrower vestibule, as well as it may hinder maxillary dental biofilm control [29, 30].

5.2.4 Basics of the Surgical Sequence

The surgical sequences depicted below are based on the modified protocol proposed by Silva et al. [29]. After local infiltrative anesthesia of the area is reached, a partial-thickness horizontal incision is performed 1 mm coronally to the mucogingival line, from the first molar region to the midline frenum of the upper lip. At the ends of the incision, 10–12 mm vertical incisions should be performed in an apical direction and connected by another incision parallel to the first horizontal incision made. The band (strip) of tissue outlined should be removed using a superficial partial-thickness dissection. In the contralateral side, the sequence should be repeated. After that, the margins of the area of exposed connective tissue should be sutured with 5-0 or 6-0



Fig. 5.15 (a–c) Schematic representation of the lip repositioning technique. Gummy smile (a). Incision outline of the epithelial layer to be removed (b). Removal of the epithelial layer by a partial-thickness flap (c)

Teflon or nylon sutures (Figs. 5.15 and 5.16). The sutures are removed 14 days after surgery.

In addition, patients should be prescribed 0.12 % chlorhexidine gluconate and instructed to rinse gently twice a day for 1 week and to “minimize lip movement when smile-

ing or talking during the first 2 weeks postoperatively” [29]. Overall, like all other periodontal plastic surgery procedures, analgesics, anti-inflammatory drugs, and/or systemic antibiotics are prescribed if needed, as well as no adverse effects are expected in the treated sites.

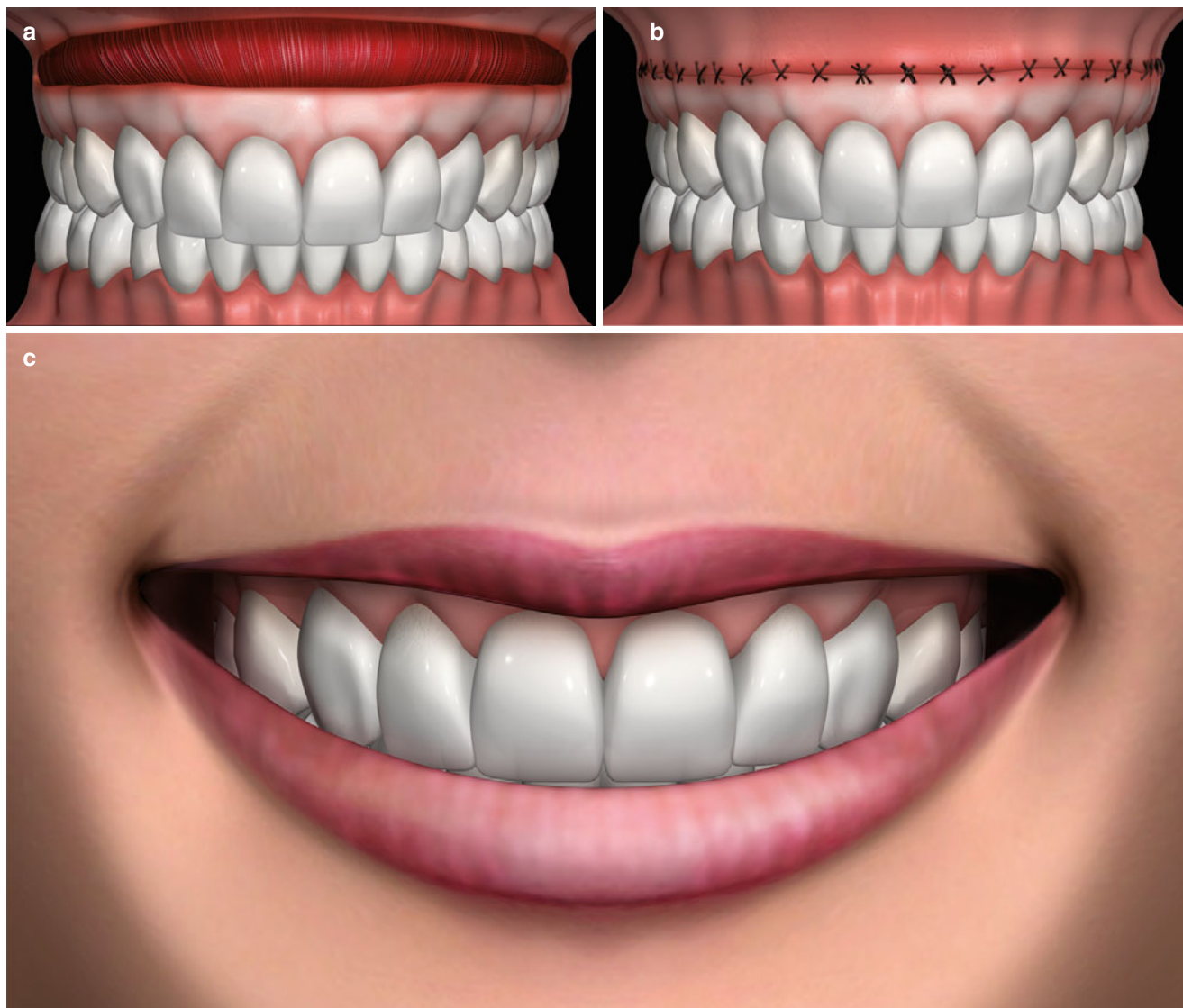


Fig. 5.16 (a–c) Expected aspect after removal of the epithelial layer (a). Surgical wound suture (b). Expected final outcome (c)

5.2.5 Clinical Remarks: Implication for Practice and Decision-Making on Lip Repositioning

Like any other esthetical procedure, it is important to note that lip repositioning should be performed only in patients concerned with their smile and seeking for treatment. In the short term, it has demonstrated satisfactory outcomes when

performed within patients presenting a “gummy smile.” It is important to note that the percentage of success related to the use of this procedure seems directly associated to its correct indication/prescription (only for patients with excessive gingival display caused by hyperactive upper lip), as well as surgical/restorative approaches may be used concomitantly to improve the final esthetical outcomes (Figs. 5.17, 5.18, 5.19, and 5.20).



Fig. 5.17 Case I 18 (a-i) – Lip repositioning procedure for treating gummy smile. Baseline (a). Presence of a wide band of keratinized width (b). Delimitation of the epithelial layer to be removed (c). Surgical site after removal of the partial-thickness epithelial layer (d). Surgical site after removal of the partial-thickness epithelial layer (e).

Surgical site ready for lip suture (f). Upper marginal connective tissue margin sutured to the lower margin (g). Upper marginal connective tissue margin sutured to the lower margin – frontal view (h). Final result after wound healing (i)

Fig. 5.18 Case II 19 (a–j) – Lip repositioning procedure for treating gummy smile. Baseline (a). Identification of the area to be treated (b). First horizontal incision 1 mm apical to the mucogingival junction (c). Removal of the partial-thickness epithelial layer (d). Epithelial layer removed (e). Surgical site ready to be sutured (f). Upper connective tissue margin sutured to the lower one (g). Assessment of lip tension (h). Clinical aspect after suture removal (i). Final result after wound healing (j)

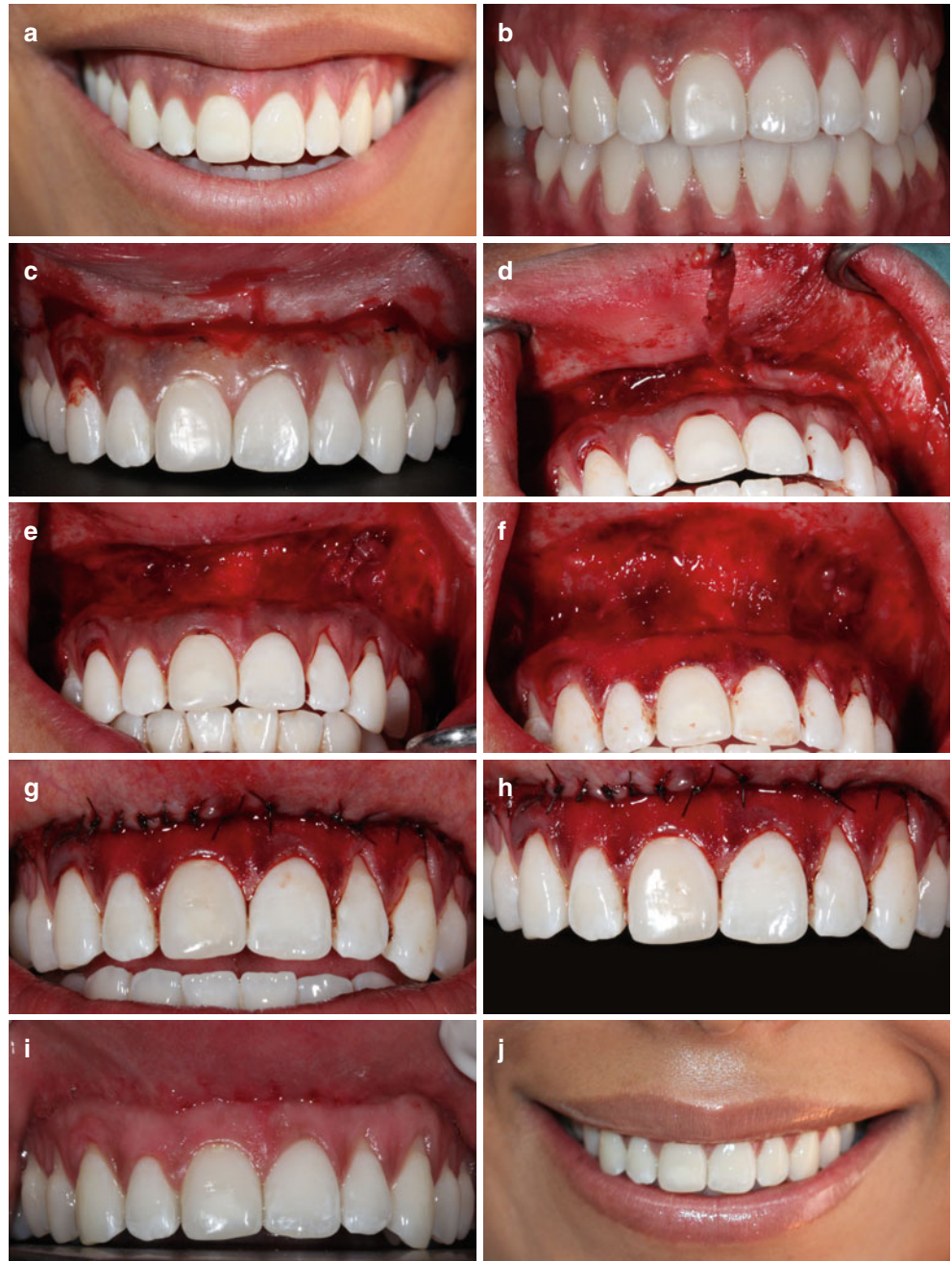




Fig. 5.19 Case III 20 (a–f) – Lip repositioning procedure for treating gummy smile. Baseline (a). Partial-thickness epithelial layer removed (b). Extension of the epithelial layer removed (c). Upper connective

tissue margin sutured to the lower one (d). Assessment of lip tension (e). Final outcome after healing of the surgical wound (f)

Fig. 5.20 Case IV 21 (a-d) – Lip repositioning procedure for treating gummy smile. Baseline (a). Partial-thickness epithelial layer removed (b). Connective tissue margins sutured (c). final result after healing of the surgical wound (d)



Critical Summary of the Results of Systematic Reviews

Systematic review conclusions: There is no information of systematic reviews concerning the use/effects lip repositioning surgery.

Summary of the review and critical remarks: Most of the literature on this topic is derived from case reports/series [1, 24, 26–28, 30]. There is only one prospective, single-arm study in the base of evidence:

Silva et al. [29] – The use of the modified lip repositioning procedure provided in high levels of patient satisfaction as a result of the reduction of the amount of gingival display caused by hyperactive upper lip.

Evidence quality rating/strength of recommendation (ADA 2013) [21]: Expert opinion for – the single prospective study available favors providing this intervention, but evidence is lacking, and expert opinion guides this recommendation.

5.3 Gingival Depigmentation

5.3.1 The Issue of “Darkened Gingiva” or “Black Gums”

As previously described in Chap. 2, the oral epithelium is formed by four layers (i.e., basal, spinous, granular, and cornea), and within each one of them, different cells such as keratinocytes, melanocytes, as well as Langerhans, Merkel, and inflammatory cells are present [31]. Within the basal cell layer, the activity of melanocytes in transforming tyrosine (i.e., a proteinogenic amino acid) [32] to melanin regulates the amount of this pigment produced and stored in the melanosomes [33–35].

Despite not considered the unique source of gingival pigmentation, melanin is certainly the most prevalent and relevant [35, 36]. Complementary, more or less genetic predisposition/expression of this pigment [37], and its effect on the color of the gingival tissues (especially the gingiva), is certainly not associated to a health or disease status [35].

5.3.2 The Depigmentation of the Gingiva: “Why and How”?

The totality of patients’ complaints concerning “darkened gingiva” or “black gums” relates to esthetic concerns, mainly among subjects presenting high smile lines [35]. Outcomes reported in base of evidence showed that gingival depigmentation may be reached by procedures based on scalpel surgery, electrosurgery, cryosurgery, gingival grafts as well as mechanical, chemical, or laser epithelial abrasion [35].

Just as a historical timeline, the following procedures have been proposed over the last decades for gingival depigmentation:

- Hirschfeld and Hirschfeld [38] – chemical abrasion
- Dummett and Bolden [39] – scalpel surgery
- Tal et al. [40] – cryosurgery
- Farnoosh [41] – mechanical abrasion (“deepithelialization”) using high-speed handpiece and diamond burs
- Deepak et al. [42] – electrosurgery

- Trelles et al. [43] – Lasers
- Tamizi et al. [44] – gingival grafts

5.3.3 Type of Condition to Be Indicated

Treatment of melanotic spots/clinical melanin pigmentation of soft periodontal tissues (gingiva) in patients with esthetic demands

5.3.4 Type of Condition Not to Be Indicated

None/lack of esthetic concern

5.3.5 Basics of the Surgical Sequence Using Scalpel Surgery or Mechanical/Laser Abrasion

Following local anesthesia, the epithelium over the pigmented area is removed by means of a partial-thickness flap that should be raised and excised, or via mechanical abrasion (with cutting hand instruments or diamond burs and handpieces) or surgical lasers (Fig. 5.21). For both procedures, bleeding may be controlled using pressure pack with sterile gauze, and the area cleaned with sterile saline solution as well. After bleeding control, the exposed depigmented surface should be covered with periodontal dressing for 1 week since suture is not performed. In addition, patients should be instructed to avoid mechanical contact/trauma with area and dressing removal before the period established. Patients should be prescribed 0.12 % chlorhexidine gluconate and instructed to rinse gently twice a day for 2–3 weeks, or until safe and comfortable toothbrushing can be performed. Overall, analgesics and anti-inflammatory drugs are prescribed to control pain, as well as antibiotics may be used due to the great area of connective tissue exposure. Except for pain, no adverse effects are expected in the treated sites, but bleeding caused by trauma/contact may occur if the dressing is removed earlier than recommended.

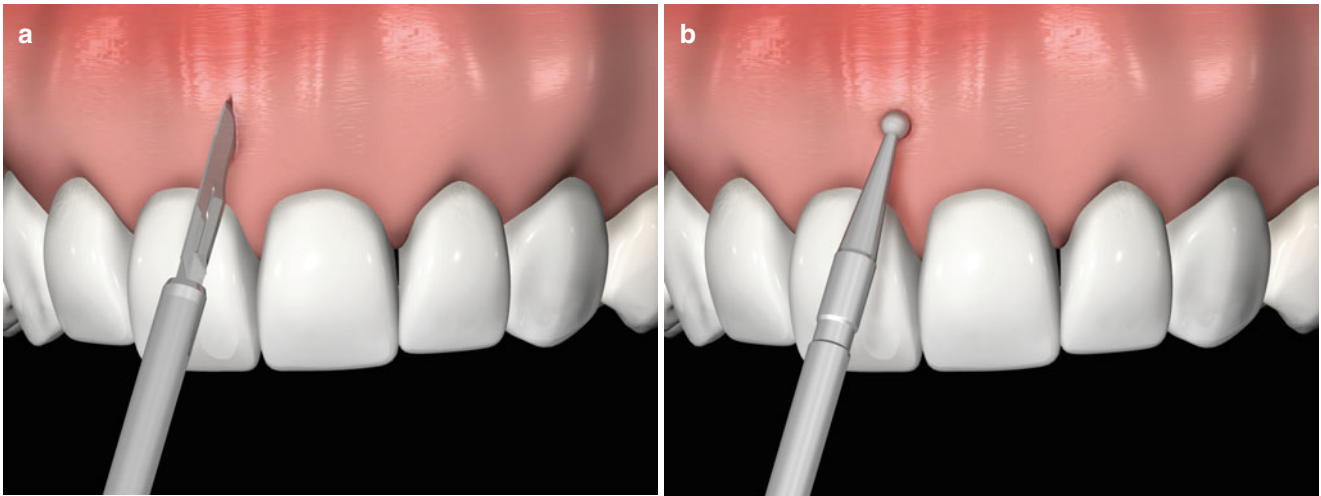


Fig. 5.21 (a, b) Gingival depigmentation by mechanical abrasion. Scraping using a surgical blade (a). Scraping using a handpiece and bur (b)

5.3.6 Clinical Remarks: Implications for Practice and Clinical Decision-Making on Gingival Depigmentation

The use of gingival depigmentation procedures may be safely applied within patients seeking for improvements in gingival color. Most of the melanotic spots/melanin pigmentation of the gingiva may be eliminated, but repigmentation may occur specially at sites treated with bur abrasion

(9.0 % of recurrence ratio) or by scalpel surgery (4.2 %) [35]. For the other approaches, the rates of recurrence were of 2.0 % for gingival grafts, 1.2 % for laser surgery, 0.7 % for electrosurgery, and 0.3 % for cryosurgery [35]. Because of the nonfunctional nature of this treatment modality, it should be interesting to define the approach of choice/treatment modality based on the clinicians' skills and the cost-benefit for the patient (Figs. 5.22, 5.23, 5.24, 5.25, 5.26, and 5.27).



Fig. 5.22 Case I – Gingival depigmentation by laser (in collaboration with Dr. Alberto Blay). Baseline (a, b). Surgical laser application (c, d). Six months follow (e, f)

Fig. 5.23 Case II 24 (a–f) – Gingival depigmentation by scalpel surgery (epithelial removal via a partial-thickness flap). Baseline (a). Removal of some areas of gingival hyperplasia (b). Flap raising (c). Flap raised before the removal of the epithelial layer (d). One week follow-up (e). Six months follow-up (f)

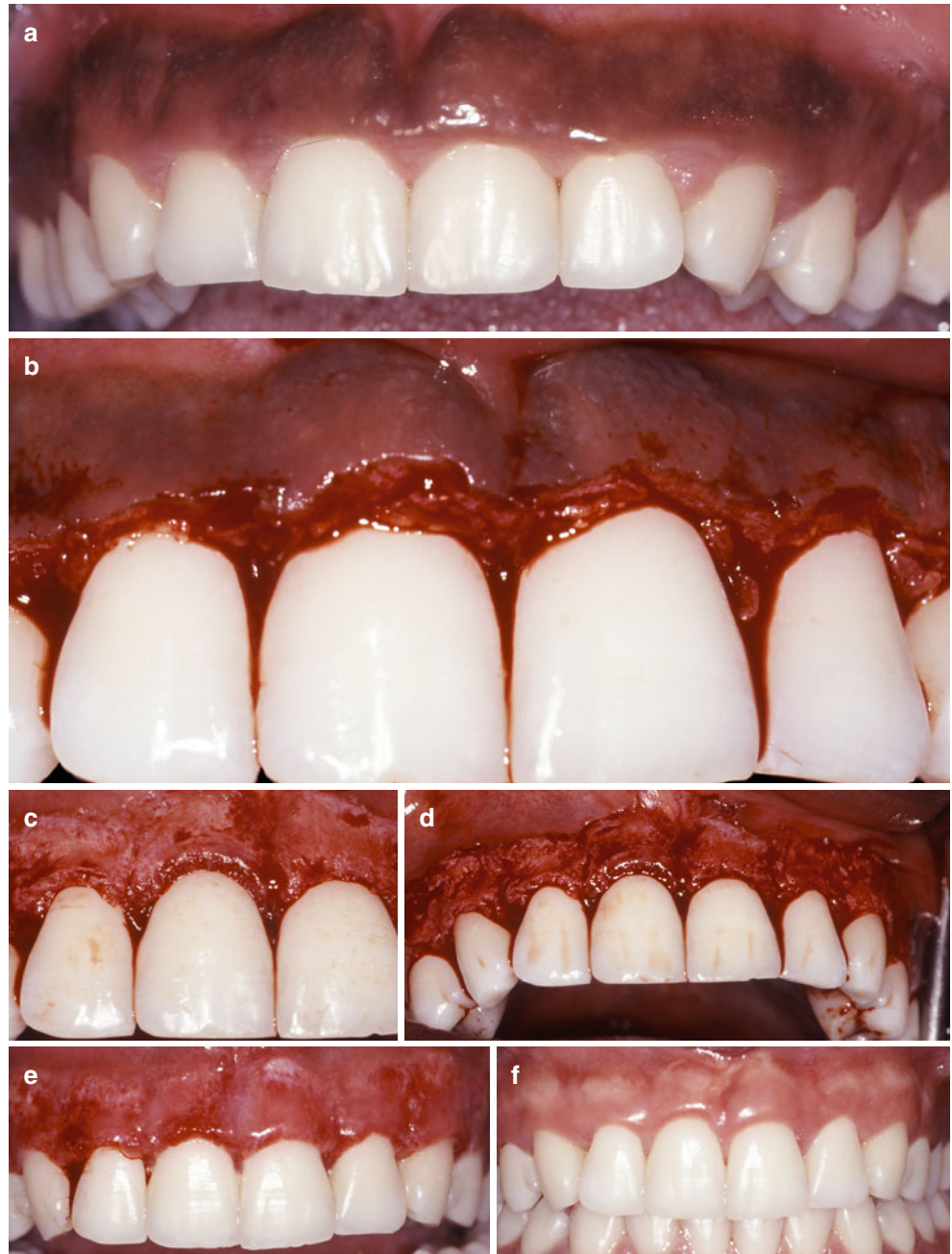




Fig. 5.24 Case III 25 (a–g) – Gingival depigmentation by scalpel surgery (epithelial removal by partial-thickness flap) in a heavy smoker (>20 cigarettes a day). Baseline (a). Epithelial layer removed (b). Three weeks follow-up – moment of the second surgical procedure in the left

side of the maxilla (c). Two months follow-up of the second surgical procedures (d). One year follow-up (e). Twenty-five years follow-up (f). Degree of keratinization observed at the last follow-up (g)



Fig. 5.25 Case IV 26 (a–d) – Gingival depigmentation via mechanical abrasion of the epithelial layer. Baseline (a). Mechanical abrasion performed by scrapping of the surgical blade (b, c). Three months follow-up (d)

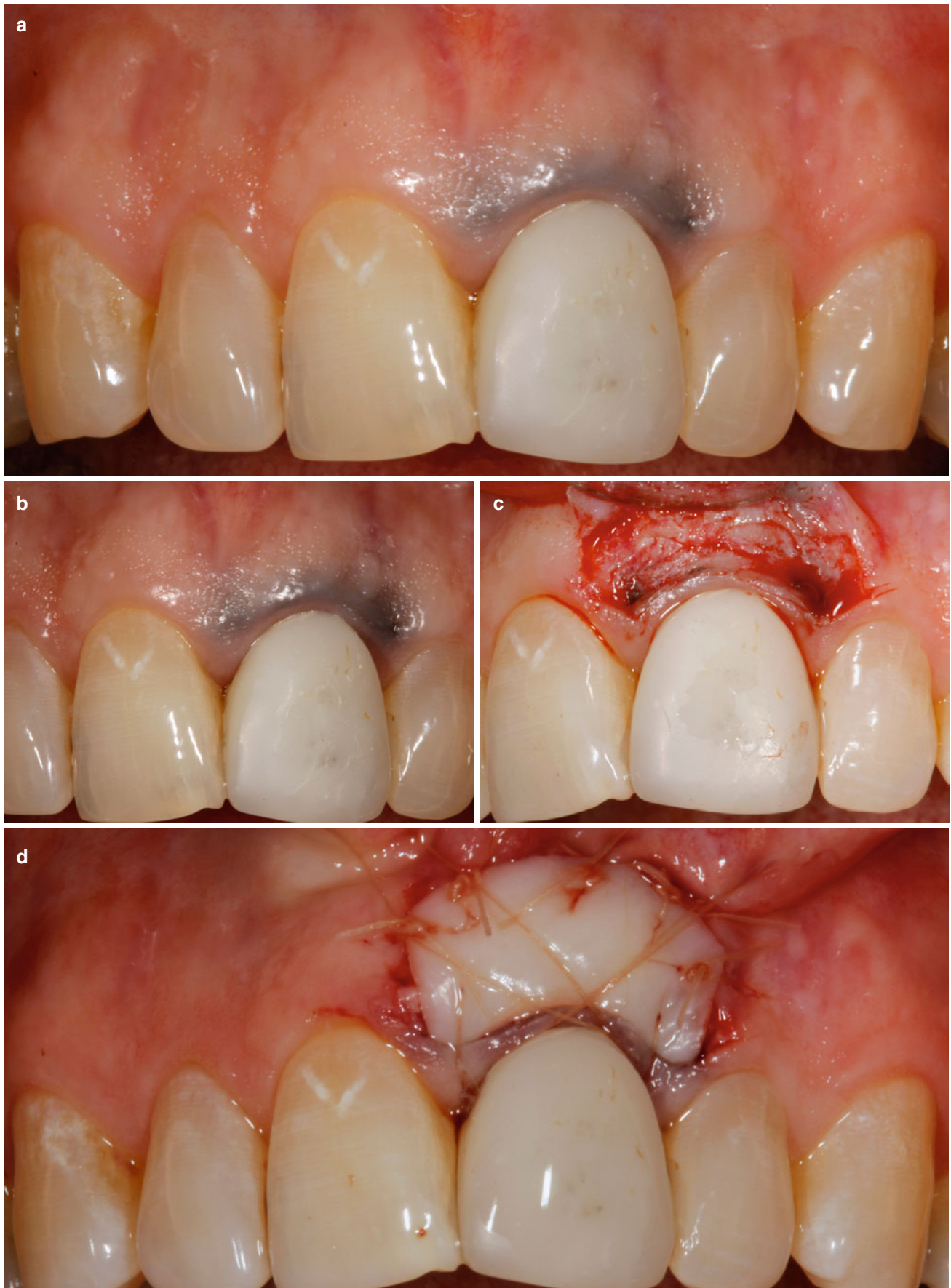


Fig. 5.26 Case V 27 (a–g) – Gingival depigmentation via soft tissue grafting. Baseline (a). Amalgam tattoo in buccal gingiva around tooth 21 (b). Removal of the affected soft tissue – partial-thickness flap (c). Free gingival graft sutured at the area (d, e). Four months follow-up (f, g)



Fig. 5.26 (continued)



Fig. 5.27 Case VI 28 (a–d) – Gingival depigmentation via soft tissue grafting. Baseline (a). Amalgam tattoo in the gingival tissue among teeth 12 and 13 (b). Removal of the soft tissue containing the tattoo and suture of a subepithelial connective tissue graft (c). Two months follow-up (d)

Critical Summary of the Results of Systematic Reviews

Systematic reviews conclusions: All methods for treating gingival melanin pigmentation may be associated to some percentage of recurrence [35].

Summary of the reviews and critical remarks: The base of efficacy studies is scarce. Most of the data included in the unique SR available regard case reports/case series [35]. Regarding the repigmentation of treated sites, the outcomes of some of these studies are depicted below:

Kaur et al. [45] – 15 of the 20 patients treated with scalpel surgery presented some repigmentation of the treated sites at 9 months postsurgery.

Pontes et al. [46] – 1 of 15 and 10 of 15 sites treated with scalpel surgery + acellular dermal matrix graft or bur

abrasion, respectively, presented repigmentation after 6 months. At 12 months, 8 and 15 (100 %) presented the outcome, respectively, in this RCT.

Singh et al. [47] – In this randomized study, 1 (10 %) out of the 10 treated patients presented repigmentation independently with treated sites with diode laser or cryosurgery 18 months after therapy.

Famoosh [41] – 2 (10 %) of 20 patients treated with bur abrasions presented repigmentation 20 months after treatment.

Evidence quality rating/strength of recommendation (ADA 2013) [21]: Expert opinion for – the single SRs available favors providing this intervention, but adequate evidence is lacking, and expert opinion guides this recommendation.

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