LEARNING OBJECTIVES
- To understand the importance of 'pink' or periodontal aesthetics in overall smile aesthetics, including the ideal standards
- To consider the aetiology and management of both a 'gummy' smile and gingival recession

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PINK AESTHETICS: GUMMY SMILES AND GINGIVAL RECESSION

ABSTRACT

The ideal smile is one where there is harmony between the 'white' (tooth) and 'pink' (periodontal) aesthetics. The developments in the field of periodontology have enhanced aesthetic outcomes when managing excessive gingival exposure in a 'gummy' smile or excessive tooth exposure in gingival recession cases. This paper aims to outline the aetiology, classification, and management of both a 'gummy' smile and gingival recession, putting a spotlight on aesthetics.

Introduction

'Pink' or periodontal aesthetics is an integral component of overall smile aesthetics. As the demand for aesthetic treatments has increased, the field of periodontology has also evolved with a greater focus on periodontal plastic surgery to provide optimal smile aesthetics once health and function have been restored.

There are several conditions and factors that may influence 'pink' aesthetics. A 'gummy' smile and gingival recession are at opposite ends of the spectrum but can have an equally detrimental impact on periodontal aesthetics.[1] The former can cause excessive gingival exposure when smiling or speaking and the latter, excessive tooth exposure.

This paper will discuss the aetiology, classification, and management of both a 'gummy' smile and gingival recession with a key focus on aesthetics.

The 'gummy' smile

A smile is generally defined as pleasant when it exposes the entirety of the maxillary teeth along with approximately 1mm of facial gingiva. Gingival exposure of up to 2 – 3mm is normally found acceptable, whereas patients are usually dissatisfied with any greater exposure (> 3mm).[2] Patients with a high smile line who expose a large band of gingiva may be classified as having a 'gummy' smile (Figure 1). According to the most recent classification scheme, under the umbrella of mucogingival deformities and conditions, the term gingival excess has been used.[3] The causes of excessive gingival show are numerous and may involve different anatomical structures individually and/or together. The most common causes include altered passive eruption, dentoalveolar extrusion following attritive tooth wear, vertical maxillary excess and a short or hypermobile upper lip. It's important to establish the aetiology for the 'gummy' smile, as not all will be well-suited to periodontal plastic surgery procedures. For example, conditions such as vertical maxillary excess may require maxillofacial surgery to resolve, and a hypermobile lip may benefit from botulinum toxin injections or lip repositioning surgery.
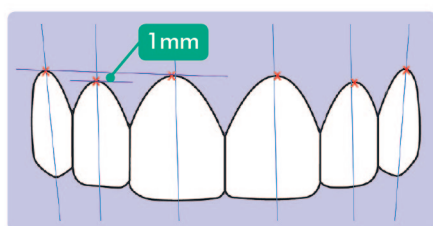
Figure 1: A 'gummy' smile
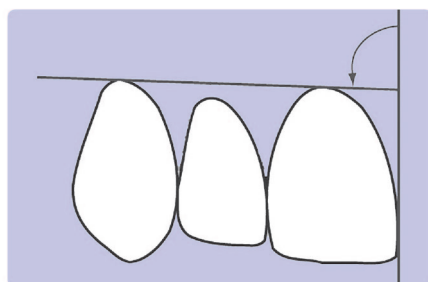

Figure 2: Ideal gingival aesthetics

Figure 3: Gingival aesthetic
line and angle

Altered passive eruption

Passive eruption commences after the tooth's anatomical crown has fully erupted and is characterised by the apical shift of the dentogingival junction. The length of the clinical crown increases as the epithelial attachment migrates apically. Apical migration of the dentogingival junction continues until it reaches a physiologic distance of 0.5 – 2.0mm coronal to the cementoenamel junction (CEJ). If alterations occur during the passive phase of tooth eruption, the gingival margin may fail to retract to the full extent, giving rise to the phenomenon of altered passive eruption. Altered passive eruption was first defined by Goldman and Cohen.[4] Coslet et al. later developed

TABLE 1

CLASSIFICATION OF ALTERED PASSIVE ERUPTION

Classification	Description	
Type 1A	Wide band of keratinised tissue (> 2mm)	Distance between CEJ and alveolar bone crest 1.5 – 2mm
Type 1B	Wide band of keratinised tissue (> 2mm)	CEJ and alveolar bone crest close or at same level
Type 2A	Narrow band of keratinised tissue (≤ 2mm)	Distance between CEJ and alveolar bone crest 1.5 – 2mm
Type 2B	Narrow band of keratinised tissue (≤ 2mm)	CEJ and alveolar bone crest close or at same level

a classification system, based upon the relationship between the gingivae and the underlying alveolar bone (Table 1).[5] According to Nart et al., altered passive eruption may affect around 35% of the population.[6] The gingival margin position in relation to the CEJ and buccal bone crest as well as the crown-root–alveolar crest relationships need to be evaluated to ascertain if a 'gummy' smile is due to altered passive eruption.

Ideal gingival aesthetics

The ideal gingival architecture consists of several features:

- Gingival zenith position: The gingival zenith is the most apical point of the gingival outline. According to Chu et al. (2009), the gingival zeniths of the maxillary central incisors should be approximately 1mm distal to the midline of the crown, the zeniths of the lateral incisors 0.4mm distal and the zeniths of the canine usually centralised along the long axis[7] (Figure 2).
- Relative gingival margins: Apico-coronally the zeniths of the lateral incisors should be 1mm coronal to central incisors and canines (Figure 2).
- The gingival aesthetic line is defined as the line joining the tangents of the central incisor and canine zeniths. The gingival aesthetic line angle is that formed at the intersection of this line to the maxillary dental midline. The ideal angle is between 45 and 90 degrees (Figure 3). In the same respect, gingival symmetry between the right and left side of the mouth is an important consideration.

- Approximate ideal width-to-height tooth ratios are as follows: central incisor = 80%, lateral incisor = 70%, and canine = 75%.[8]

Crown lengthening

To correct a 'gummy' smile resulting from conditions such as altered passive eruption, aesthetic crown lengthening can be performed. Crown lengthening has been described by Cohen et al. as the surgical removal of hard and soft periodontal tissue to gain supragingival tooth length allowing for longer clinical crowns and the re-establishment of the biologic width.[9] Patients now frequently call this procedure a 'gum lift'. The term 'biologic width' was recently replaced with the term 'supracrestal tissue attachment'.[3] This encompasses the junctional epithelium and supracrestal connective tissue (Figure 4). According to Garguilo et al.[10] this should be approximately 2mm. If the supracrestal tissue attachment is not respected or
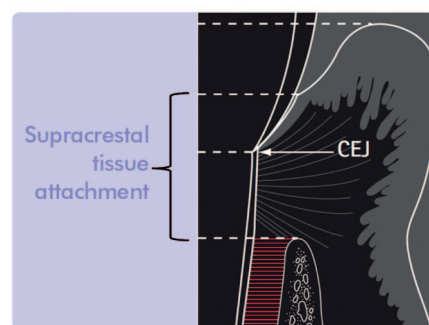

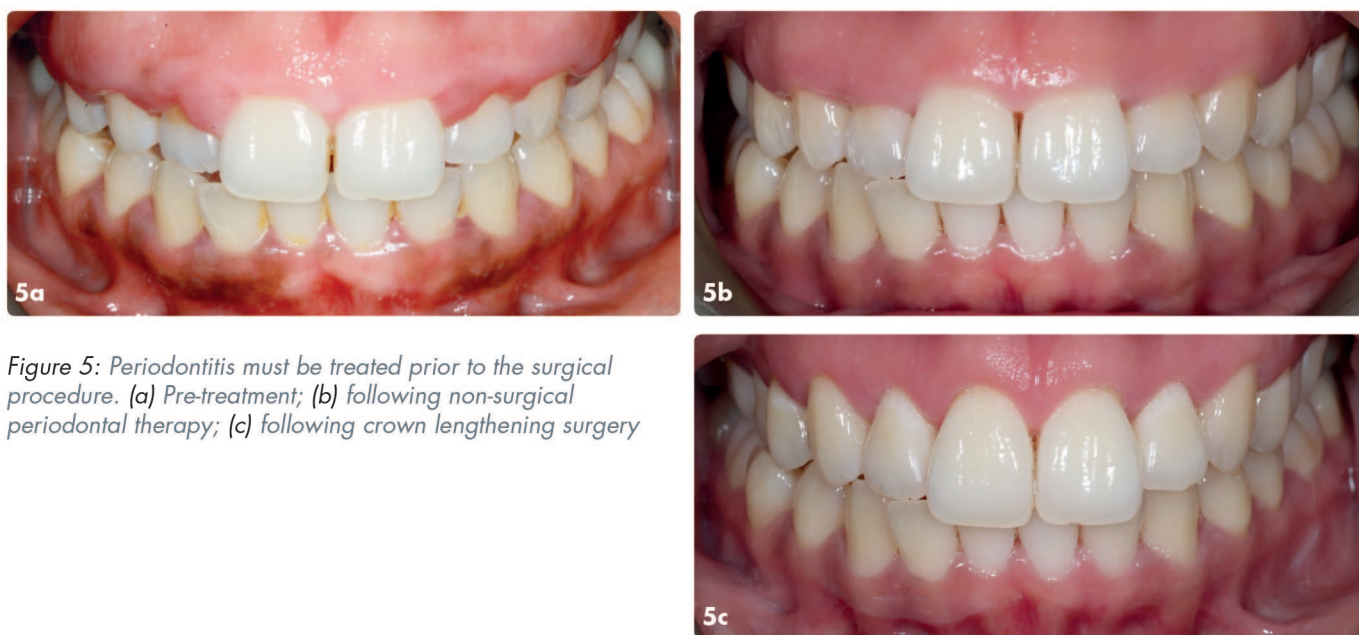Figure 4: Supracrestal tissue attachment

Figure 5: Periodontitis must be treated prior to the surgical procedure. (a) Pre-treatment; (b) following non-surgical periodontal therapy; (c) following crown lengthening surgery

recreated this will result in the unwanted consequences of gingival inflammation, pocketing, recession, and/or bone loss.

The planning phase prior to the surgical procedure is critical for a successful outcome. It is important to confirm periodontal health and optimal plaque control prior to any elective aesthetic surgical procedures. For this reason, if the patient is diagnosed with periodontitis, this needs to be treated first (Figure 5). Other local factors such as the crown:root ratio, level of the furcation entrance, root proximity and endodontic status of the tooth should also be assessed. The reference point or finish line would need to be determined. This is usually the CEJ for altered passive eruption cases but could also be a reference point on the tooth, existing/provisional restorations or that guided by a surgical stent. Evaluating the gingival architecture and extent of the smile will determine how much and how many teeth will require crown lengthening. The amount of keratinised tissue needs to be assessed as this will determine the surgical approach: resective versus apically positioning tissues (or a combination of both). It is preferable to leave at least 2mm of keratinised tissue post-surgery to enable the patient to maintain an optimal level of plaque control more comfortably than if there was only (non-keratinised) lining mucosa remaining. The position of the

FIGURE 6

SURGICAL APPROACHES FOR CROWN LENGTHENING
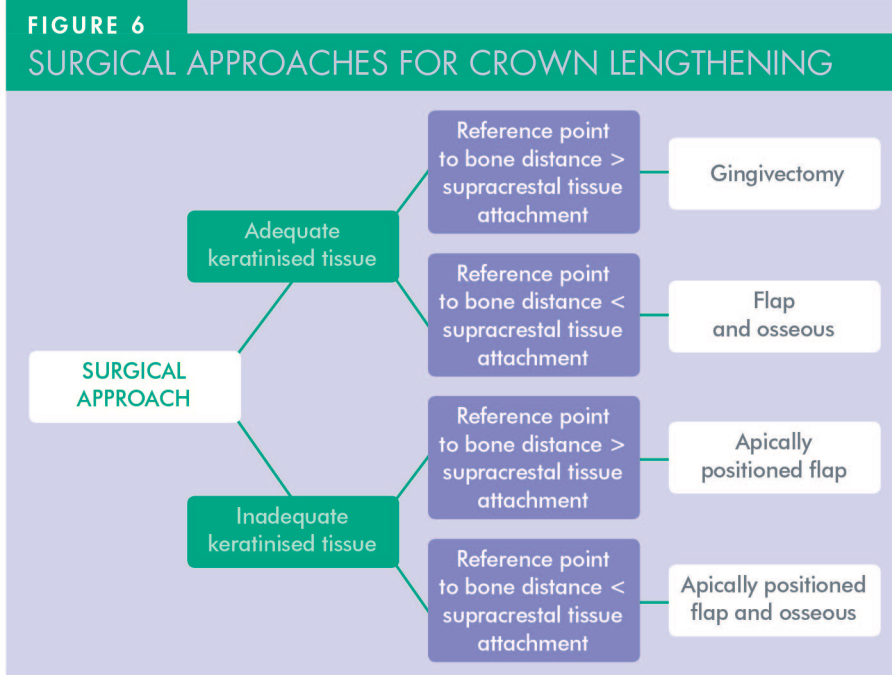
bone and the distance between the bone level and reference point will then determine the amount of bone removal that will be required, if any. Good quality periapical radiographs and bone sounding will be useful to help determine the position of the bone. Figure 6 summarises the various surgical approaches. During the planning phase, involvement of the patient will ensure that patient expectations are met, or

unrealistic expectations are clarified. Annotated photographs (Figure 7), composite mock-ups in the mouth and wax-ups can all be helpful for the patient to visualise the result (Figure 8).

For the surgical procedure in aesthetic crown lengthening, only a buccal flap is raised and only buccal bone removal is required. However, with restorative crown lengthening, both a buccal and

Figure 7: An example of an annotated photograph, which can help a patient visualise the results of planned surgery
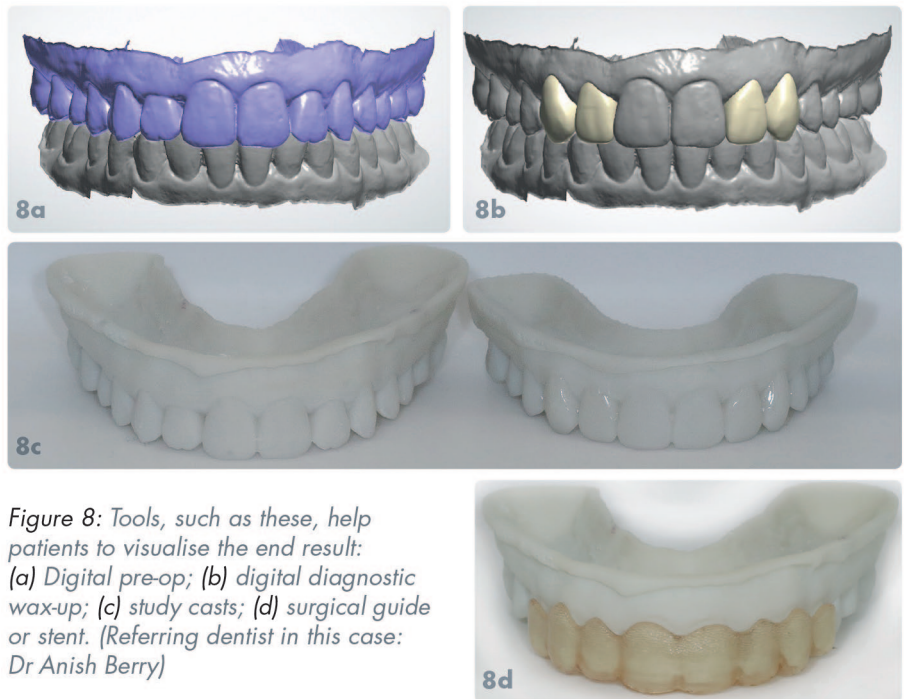

Figure 8: Tools, such as these, help patients to visualise the end result: (a) Digital pre-op; (b) digital diagnostic wax-up; (c) study casts; (d) surgical guide or stent. (Referring dentist in this case: Dr Anish Berry)

palatal/lingual flap are raised as bone removal is usually necessary for all surfaces. For aesthetic cases, to reduce the chances of 'black triangles' developing, the interproximal tissue can be preserved by not including it in the flap design. Vertical incisions are usually avoided to minimise any scarring. When considering osseous management, both ostectomy and osteoplasty may be required. The aim is to remove sufficient bone to re-establish the supracrestal tissue attachment and ensure there is a gradual rise and fall in the profile of the osseous crest to recreate a positive architecture. Suture technique is usually single interrupted or mattress sutures. A fine suture is used (usually 6-0) with the exact material being of operator preference. These are removed approximately two weeks following the surgical procedure.

Altered passive eruption cases may not always require restorative work following surgery unless there is also a need to improve the tooth aesthetics. If crown lengthening has been completed for tooth wear cases following dentoalveolar extrusion, then a restorative phase will likely follow. Provisional restorations can be placed after suture removal but for those teeth in the aesthetic zone, there is limited evidence to suggest that it may be wise to wait around six months prior to the placement of the definitive restorations as the position of the gingival crest may continue to change until then.[11] Coronal displacement of the gingival margin appears to be more pronounced in thick gingival phenotypes but all patients should be consented for a revision surgery in case it is required.

Crown lengthening as a stand-alone treatment can have a significant

impact on the overall smile aesthetics and an individual's confidence (Figure 9). It can be equally powerful as part of a multidisciplinary case,

for example after orthodontics on selected teeth (Figure 10) or in combination with restorative treatment (Figure 11).

Figure 9: (a) Pre-crown lengthening surgery; (b) post-treatment

Figure 10: Crown lengthening surgery (a) Post-orthodontics; (b) post-crown lengthening

Figure 11: Multidisciplinary crown lengthening case. (a) Pre-treatment; (b) post-treatment. (Crown lengthening by author; ceramic veeners by Dr Sahil Patel, referring dentist in this case)
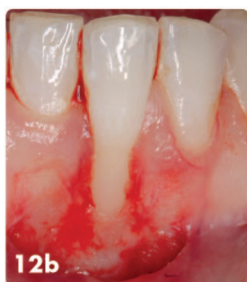

Figure 12: Gingival recession: (a) Pre-op; (b) dehiscence present after raising flap

Gingival recession

Gingival recession occurs when there is an apical shift of the gingival margin with subsequent exposure of the root surface.[12] Root exposure can negatively impact on aesthetic outcomes and is one of the most common reasons for patients seeking periodontal care. Recession may vary in extent as well as severity. The impact it has on an individual is case dependant. The development of gingival recession is not an inevitable consequence of age, but it is to a degree a reflection of some pathological change or a variation on normal anatomy.

Aetiology of gingival recession

There is usually a combination of both predisposing and precipitating factors when studying the aetiology of gingival recession. Predisposing factors increase the patient's risk to gingival recession, whereas precipitating factors trigger it.

A key predisposing soft tissue feature is a thin gingival phenotype. If the probe can be seen shining through the gingival tissue it can be defined as thin. Patients with a thin phenotype have a more delicate type of gingiva compared to that of a thick phenotype and so will be more prone to developing recession. Other soft tissue factors include a high frenal attachment and a shallow vestibular depth. Hard tissue factors that can predispose an individual to gingival recession include thin buccal bone as well as a dehiscence (Figure 12) or fenestration.[13] The tooth position in the arch (either anatomical or following orthodontics) as well as a discrepancy in the size of the root versus the width of the bone will similarly be contributing factors. Loss of interproximal bone support will also predispose an individual to gingival recession.

The two major precipitating factors for gingival recession are trauma and plaque. The most frequently discussed trauma is overzealous brushing. Typically, these patients will have only buccal recession without interdental soft tissue loss. Flossing trauma may cause damage in the form of Stillman's clefts. Habits such as fingernail biting and picking at the gum line might trigger gingival recession. Tongue piercings often lead to lingual recession (Figure 13) and lip piercings may contribute to labial recession. Trauma may also occur through a malocclusion, such as a traumatic overbite affecting the palatal soft tissues or the labial soft tissues of the lower incisors which is sometimes seen in individuals with severe class II division 2 malocclusion. Poor plaque/biofilm control will lead to inflammation and gingival recession.

The clinician's role is to find these factors and ensure the management of the modifiable ones regardless of whether any surgical procedures are completed. For example, if overzealous brushing has not been identified and corrected, any periodontal plastic surgery procedure that follows will not be successful in the long term.

Classification of gingival recession

Previously, gingival recession was categorised using Miller's classification.[14] The latest classification system,[3] divides gingival recession into three different recession types (RT).

- **RT1:** Gingival recession with no loss of interproximal attachment. Interproximal CEJ is clinically not detectable at both mesial and distal aspects of the tooth
- **RT2:** Gingival recession associated with loss of interproximal attachment. The amount of interproximal attachment loss is less than or equal to the buccal attachment

Figure 13: Tongue piercings (a) can lead to lingual recession (b)

Figure 14: (a) *Without gingival veener*; (b) *gingival veneer in situ*

- **RT3:** Gingival recession associated with loss of interproximal attachment. The amount of interproximal attachment loss is higher than the buccal attachment loss

Further detail can be added on the depth of the recession, gingival thickness, keratinised tissue width, presence of a detectable CEJ, and existence of a root surface concavity.

Factors affecting root coverage
Improving 'pink' aesthetics, especially when driven by the patient, is a frequent reason to intervene surgically. Prevention of progression and keratinised tissue augmentation are some of the other reasons. The ideal outcome, i.e. complete root coverage, is not possible for all cases. The level of interdental support is the most crucial prognostic factor, which is why severe periodontitis patients are usually not suitable candidates for surgical root coverage procedures. There are still no techniques that can predictably recreate lost interdental papillae, but our ability to cover labial recession is also dependent on there being good interproximal tissues. Gingival veneers may be an efficient alternative to improve aesthetic outcomes in these patients (Figure 14).

Complete root coverage is more likely to be achieved in sites with a lower height of interdental papilla.[15] Tooth rotation or extrusion will negatively impact on complete root coverage due to its impact on papilla height. The wider and deeper a defect, the less likelihood of achieving complete root coverage due to a lack of blood supply. Convex surfaces may have a detrimental effect. The survival of the flap, and particularly the marginal gingiva, depends on the residual vascular system after surgical incisions. The thicker the flap, the greater the vascularisation of the marginal gingiva and the probability of complete root coverage.[16]

In terms of the surgical technique, approaches that make the flap passive plays a major role in enhancing optimal wound healing to achieve adequate coverage. Pini Prato et al. showed that the greater the flap tension (suggested flap tension should not exceed 4g), the less successful the recession improvement.[17] Soft tissue healing pattern after root coverage procedures is usually linked to a shrinkage of the surgical wound. The location of the gingival margin relative to the CEJ after the surgery seems to affect the probability of complete root coverage; the more coronal the margin after suturing, the greater the probability of achieving complete root coverage.[18] A coronal displacement of 2mm relative to the CEJ is suggested.

Patient factors such as smoking and suboptimal plaque control usually rule out any aesthetic surgical procedures.

Surgery for aesthetic recession coverage
Aesthetic 'shortening' of the tooth following gingival recession can be accomplished with root coverage surgical procedures. The ultimate goal of a root coverage procedure is complete coverage of the recession defect with a good appearance related to the adjacent soft tissues and minimal probing depths following healing.[19] There are a number of surgical procedures that have been described and they can be summarised as shown

| TABLE 2		
SURGICAL TECHNIQUES FOR TREATING GINGIVAL RECESSION		
Pedicle soft tissue graft procedures	Rotational flap procedures	Laterally sliding flap
		Double papilla flap
		Oblique rotational flap
	Advanced flap procedures	Coronally advanced flap
		Semilunar coronally repositioned flap
	Regenerative procedures	
	Tunnelling	
Free soft tissue graft procedures	Epithelised graft	
	Subepithelial connective tissue graft	
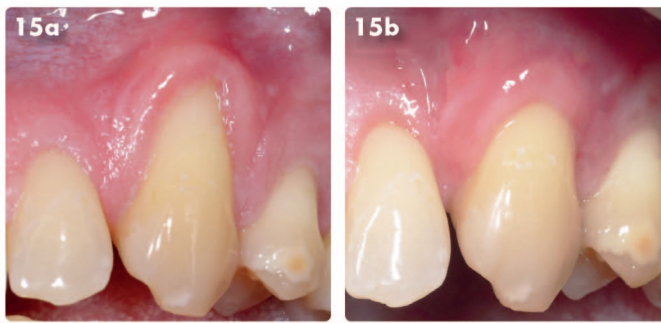
Figure 15: Gingival recession surgery: The coronally advanced flap is the technique of choice for isolated recession defects. (a) Pre-treatment; (b) post-treatment
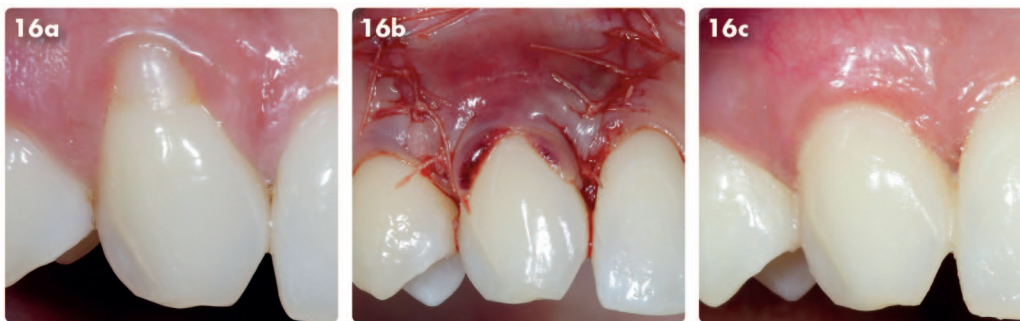

Figure 16: Gingival recession surgery: Trapezoidal flap design and split–full–split-thickness flap elevation technique. (a) Pre-treatment; (b) immediate post-surgery; (c) one month post-surgery

in Table 2.[20] The international literature has extensively documented that gingival recession can be successfully treated using several surgical procedures, irrespective of the technique utilised, provided that the biological conditions for accomplishing complete root coverage are satisfied. The selection of one surgical technique over another depends on defect as well as patient factors.

The coronally advanced flap is a pedicle soft tissue graft procedure, based on a coronal shift of the soft tissues on the exposed root surface. It is the technique of choice for isolated recession defects (Figure 15). The most recent version of this technique is using a trapezoidal flap design and a split–full–split-thickness flap elevation approach (Figure 16).[21] The split or partial thickness elevation at the level of the surgical papilla provides anchorage and blood supply to the interproximal areas as well as improving blending (in terms of colour and thickness). The full-thickness elevation of the soft tissue apical to the root exposure confers the maximum flap thickness and thus provides a better opportunity to achieve root coverage to that portion of the flap residing over the exposed avascular root surface. The more apical split-thickness flap elevation facilitates the coronal displacement of the flap.

There is extensive evidence for root coverage procedures in the treatment of localised gingival recession defects, while few studies are currently available reporting the outcomes for the treatment of multiple gingival recessions.[22] The coronally advanced flap for multiple recession defects was introduced by Zucchelli and De Sanctis[23] as a novel approach to treat more than two adjacent teeth with gingival recession. This technique comprises an envelope type of flap (with no vertical releasing incisions) that anticipates the rotational movement of the surgical papillae during the coronal advancement of the flap (Figure 17). When multiple recession defects are present in one area, it is usually sensible to treat them all with one procedure rather than focus on the deepest defect alone. Coronally advanced flaps are often used in conjunction with a connective tissue graft sandwiched underneath. This is common when there is lack of keratinised tissue, or the flap is thin. By covering the graft, it also has an increased blood supply, and the aesthetic outcome is improved by hiding the white-scar appearance of the grated tissue. Alternative materials to the palatal connective tissue graft are available but these are likely to be less predictable. Treatment of multiple recession defects with coronally advanced flaps with or without connective tissue grafts can have a

Figure 17: Coronally advanced flap for multiple recession defects. (a) Pre-treatment; (b) immediate post-surgery; (c) three months post-surgery

Figure 18: Gingival recession surgery: (a) Pre-treatment smile; (b) pre-treatment retracted; (c) post-treatment smile; (d) post-treatment retracted

Figure 19: Gingival recession surgery: (a) Pre-treatment smile; (b) pre-treatment retracted; (c) post-treatment smile; (d) post-treatment retracted
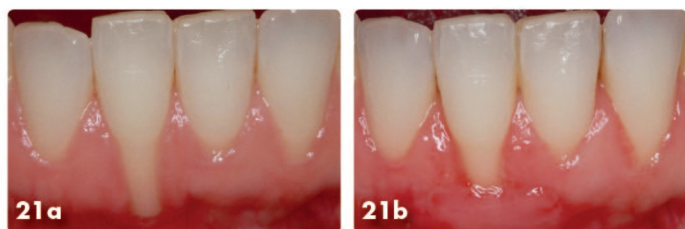

Figure 21: Free gingival graft – full coverage is not predictable. (a) Pre-surgery; (b) post-surgery

Figure 20: Composite restorations completed to the level of the CEJ, then coronally advanced flap with a connective tissue graft performed. (a) Pre-treatment; (b) post-treatment. (Referring dentist in this case: Dr Zaeem Jafri)

characteristic of this procedure is that the interdental papillae are left intact. A connective tissue graft is placed in the tunnel, and it does not need to be completely covered if the dimension of the graft is sufficient to ensure graft survival. Arguably, the main advantage of the technique is the minimally invasive nature of the surgery. Recently, the tunnel technique was modified to include coronal positioning of the marginal tissue, which allows complete coverage of the graft.

Other techniques are not ideal when it comes to achieving the best 'pink' aesthetics. For example, the laterally repositioned flap is advocated when the local anatomic conditions may render the coronally advanced flap (CAF) as a contraindication. However, it is not the technique of choice in patients with high aesthetic demands as scar tissue forms in the secondary intention healing at the donor site. The free gingival graft is the most widely used surgical technique for improving the quality of the gingivae, particularly increasing the width of attached gingiva. Nevertheless, when it comes to predictable root coverage the results are less predictable (Figure 21) and the mismatch of colour is not ideal

considerable impact on periodontal and overall smile aesthetics (Figures 18 and 19). Often a combined restorative approach is required in cases of abrasive tooth wear. In Figure 20, the referring dentist completed composite restorations to the level of the CEJ and then a coronally advanced flap with a connective tissue graft was performed.

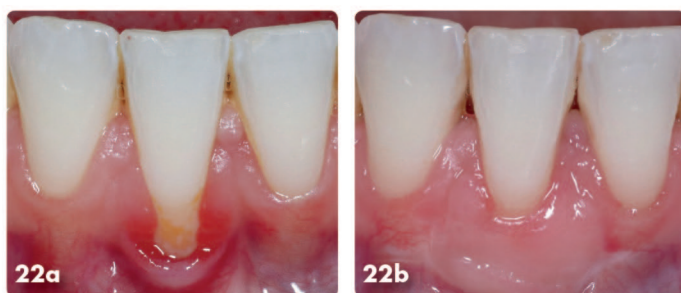The tunnel procedure for root coverage was introduced in 1994.[24] The unique

Figure 22:
Free gingival graft – coverage achieved but clear colour mismatch.
(a) Pre-surgery;
(b) post-surgery

for patients with high aesthetic demands (Figure 22). For this reason, it is best suited in areas not in the aesthetic zone.

At present, there is a lack of good quality evidence for other procedures such as the 'pinhole' surgical technique.

Conclusion

Appreciation of 'pink' aesthetics is becoming increasingly important in our goal to achieve the best clinical outcomes and meet our patients' expectations. Both a 'gummy' smile and gingival recession can impact on aesthetics. Understanding their aetiology, diagnosing them accurately and being aware of when our patients may benefit from treatment is an important and valuable duty for all clinicians in practice.

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