Gingival Management and Retraction

21

Jenna Trainor, Andrew Keeling, and Robert Wassell

21.1 Learning Points

This chapter will emphasise the need to:

- Ensure the gingivae are healthy and have had time to stabilise following periodontal treatment or surgery
- Discuss with patients the possibility that subgingival margins may eventually become visible
- Be aware of the medicaments and techniques used for gingival retraction in conjunction with gingival retraction cords and gingival retraction pastes
- Use a gentle technique for retraction cord placement to avoid unnecessary gingival recession
- Consider using electrosurgery or laser surgery to help with more difficult cases
- Delay retaking impressions for at least 3 weeks where gingival bleeding is an issue.

Before recording an accurate impression, we need good gingival management, particularly with preparation finishing lines either at the gingival margin (equigingival) or subgingival. Indeed, studies report critical impression defects at the finish line in over a third of cases [1, 2]. These defects reflect inadequate gingival management in the presence of inflammation, bleeding, subgingival finish lines, and

J. Trainor (✉) · R. Wassell
Department of Restorative Dentistry, Newcastle University School of Dental Sciences, Newcastle upon Tyne, UK
e-mail: jenna.trainor@ncl.ac.uk; Robert.wassell@ncl.ac.uk

A. Keeling
Department of Restorative Dentistry, Leeds School of Dentistry, Leeds, UK
e-mail: a.j.keeling@leeds.ac.uk

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gingival overgrowth. So, gingival management is not only about retraction techniques for subgingival margins but needs to be thought about well in advance of the impression appointment to control gingival inflammation.

We will use the term "retraction" to refer to "downward and outward movement of the free gingival margin that is caused by the retraction material and the technique used" [3]. Some authors use retraction and "displacement" synonymously [4], but other authors have defined displacement differently [3, 5]. To avoid confusion, we will avoid the term "displacement".

21.2 Gingival Inflammation and Bleeding Tissue

The golden rule is to *start healthy*. As outlined in Chap. 4, periodontal treatment should be completed and stabilised before recording impressions for definitive restorations, otherwise bleeding may displace impression material and cause inaccuracies. Resolution of gingival inflammation should also improve stability of the gingival margin, although in some patients, recession may eventually expose a subgingival restoration margin (see Chaps. 10 and 20), and this should be made clear when obtaining consent to treatment. If from the outset, patients understand the health benefits of a supra-gingival margin, they may be less agitated if a restoration margin becomes visible.

To ensure stability of the gingival margin following periodontal or crown lengthening surgery (see Chap. 10) in an aesthetically critical region, we recommend waiting 3–6 months before recording impressions for definitive restorations.

Any pre-existing restorations with defective margins are best replaced with well-contoured core build-ups or provisional restorations. Once a defective restoration is removed, always check for subgingival calculus which can be probed easily and removed from otherwise inaccessible proximal root surfaces. Where gingival overgrowth hampers construction of well-fitting provisional restorations, consider localised surgical methods to improve gingival contour (see Chaps. 10 and 23).

If bleeding is not controlled by gingival retraction techniques (see below), dentists often abandon the impression and reappoint the patient in 3 or 4 weeks to allow healing. To improve resolution of gingival inflammation, an antimicrobial rinse (e.g. chlorhexidine gluconate 0.12%) for 2 weeks is particularly helpful. At the next appointment, it is normally possible to record the impression or remake any still defective provisional restorations.

21.3 Subgingival Finish Line

Preparation finish lines that are supra-gingival can be recorded without any gingival retraction. However, subgingival finish lines and many equi-gingival finish lines require some form of gingival retraction, and the more subgingival, the more difficult they are to record. Marginal gingival tissue can be retracted in various ways: Mechanical, chemical, or surgical [6]. The mechanical and chemical approaches are

summarised in Table 21.1, and the surgical approaches are summarised in Table 21.2. Whilst these techniques can all be used in isolation, they are sometimes combined—particularly for more difficult cases.

Table 21.1 Gingival retraction using cord, solutions, and pastes to capture subgingival finish lines

	Description	Indication	Comments	Hazards
Retraction cord	Standard method of retraction using twisted or knitted cord	Equi-gingival finish lines (single-cord technique) or subgingival finish lines (two-cord technique)	Two-cord technique advised where the first cord if left in sulcus during impression recording to improve definition. Wetting the second cord before removal helps control haemorrhage even when solutions used (see below). Occasionally, the first cord provides sufficient retraction, and a second cord is not needed. No remaining cord should protrude from the sulcus, whilst the impression is recorded	Trauma and recession from excessive packing pressure and length of time in the sulcus Contamination by gloves may prevent impression of the gingival sulcus from setting Florid inflammation if first cord not removed
Medicament solutions	Used to soak retraction cord prior to insertion and may be applied topically to stop gingival bleeding Solutions include: Epinephrine (1:1000 conc.) Aluminium chloride Alum (e.g. aluminium potassium sulphate) Ferric sulphate (15.5% w/v)	Best used routinely with retraction cords as plain cords result in bleeding on removal in >50% cases [12]. Impregnated cords twice as effective if first soaked in solution [13]. With ferric sulphate the initially soaked cord can be removed from the sulcus and further solution applied with a special applicator to help stabilise the coagulum	Alum and epinephrine similarly haemostatic [13], retractive [14] and both give minimal postoperative inflammation [15]. Clinically, ferric sulphate appears a better haemostatic agent but needs to be rubbed firmly onto the bleeding gingival sulcus. Solutions must be washed off before impression recorded	Concerns over "epinephrine syndrome" (raised heart rate, respiratory rate, and blood pressure) when epinephrine solution used on lacerated gums in susceptible patients [16]. Concentrated solutions of alum can cause severe inflammation and tissue necrosis [17]. Solutions will concentrate if top left off bottle Ferric sulphate can stain the gums yellow-brown for a few days

(continued)

Table 21.1 (continued)

	Description	Indication	Comments	Hazards
Medicament pastes	Consist of viscous pastes (e.g. kaolin or addition silicone foam) injected into the sulcus Active ingredient: Aluminium chloride (Astringent™, 3 M ESPE 15%) (Expasyl™, Kerr 10–30%)	Used as an alternative to cords and solutions for routine cases. The amount of retraction and subsequent sulcus closure make it suitable for single rather than multiple preparations [18]. Needs to be used in combination with cord for more difficult cases as cord gives more effective retraction [18]	Claimed by manufacturers to be faster than cord. Less likely than cord to cause bleeding during placement and removal [19]. Like other medicaments can interfere with setting of addition silicones and polyethers and must be washed off completely	Contraindicated in patients with periodontal disease, open furcations or exposed bone

Table 21.2 Surgical methods to augment gingival retraction

	Description	Indication	Comments	Hazards
Electrosurgery	Controlled tissue destruction by rapid heating from radio frequency (>1.0 MHz) electrical current passing from wire tip (high current density) as a spark into the tissues. The current then travels through patient's body into large area collecting electrode (low-current density)	Uses: 1. Widen gingival sulcus (troughing) before cord placed. *N.B. avoid using on thin gingiva as unwanted recession can result* 2. Gingivectomy for overgrown tissue or for crown lengthening 3. Coagulation (ball electrode) but produces most tissue destruction and slow healing	Current types: Troughing—"cut/coag" setting (fully rectified, filtered) Gingevectomy—"cut" setting (fully rectified) Coagulation—"coag" setting (unrectified, damped)	Do not use in patients with mastoid implant hearing aids or with relative analgesia (burn risk from O_2). Contraindicated in patients with cardiac pacemakers [11]. Modern pacemakers are relatively well shielded [20] but still good practice to evacuate pacemaker patients from adjacent cubicles

(continued)

Table 21.2 (continued)

	Description	Indication	Comments	Hazards
Soft tissue laser	Neodymium-doped yttrium aluminium garnet laser: (Nd:YAG) [9] Diode laser: aluminium gallium arsenide (AlGaAs)	As for 1 and 2 above	Cuts a trough ranging from 0.25 to 0.65 mm Generally considered to be quicker than cord and lower collateral heat generation than electrosurgery, with good haemostasis and patient comfort [21]	Lack of tactile feedback Possible pain, postoperative inflammation, and recession of the tissue [17]
Rotary curettage (Gingettage)	Use of chamfered diamond bur to remove epithelial tissue within healthy sulcus to expose subgingival finish line during its preparation [22]	For subgingival preparations in healthy gingivae. Gingival sulcus depth must not exceed 3 mm, and there should be adequate keratinised gingivae [23]	Palatal tissues respond better than thinner buccal tissues [24].Not suitable technique if a periodontal probe in the sulcus can be seen through the gingiva	A slight deepening of the sulcus may result [24] Poor tactile sensation during instrumentation gives high potential for overextension and damage

21.3.1 Retraction Cords and Medicaments

The most commonly practiced approach is the one- or two-cord technique using an astringent solution (e.g. ferric sulphate solution) [7]. Cords come in a variety of presentations, but the main difference is that some cords already have impregnated medicaments, whist others are plain. Cords may be twisted, braded, or knitted. The choice is down to operator preference; we prefer knitted cords, acknowledging they pack down to a much smaller volume so tend look wider in diameter than needed.

Cords (plain or impregnated) are often dipped into a medicament solution before placement and the excess blotted off. A recent survey in the USA and Canada [4] of 696 dentists reports 92% use retraction cord with the majority using impregnated cords. Although, epinephrine solution is now used much less because of concerns of causing cardiac problems in susceptible patients, other medicament solutions may cause local problems if not handled properly (see Table 21.1).

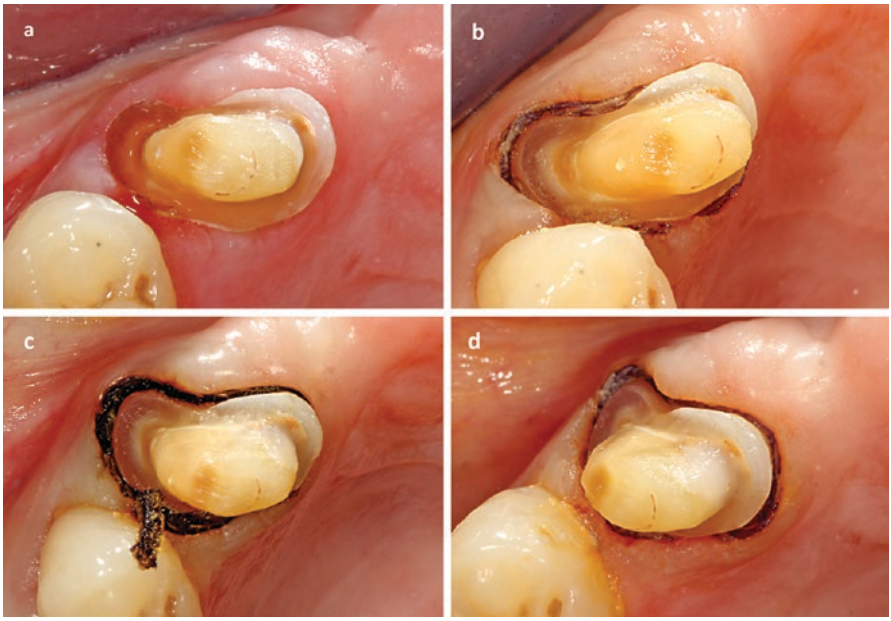

Fig. 21.1 Two-cord technique. The finishing line is partly obscured by gingival tissue (**a**) A small diameter cord is packed into the sulcus with no overlap (**b**) A second larger diameter cord is packed on top of the first one leaving a tag for removal (**c**) After rinsing away the ferric sulphate solution, the second cord is removed. The first cord is then gently dried and left to maintain gingival retraction (**d**)

The general advice for cord packing is to use a half Hollenback amalgam carver (the edge of the blade rather than the tip) or a proprietary cord packing instrument. Ambidextrous dentists can use a second instrument to help retain the cord already packed. It is best to avoid flat plastic instruments with a thick blade that cannot penetrate the gingival sulcus easily.

To avoid traumatising the gingival attachment, some dentists prefer, where possible, to pack only one cord, but there are times when a two-cord technique (see Fig. 21.1) comes into its own: For example, when bleeding and exudate needs to be controlled or when gingival recoil is likely to displace impression material from the sulcus after removing a single cord. In addition, leaving the first cord in the sulcus whilst the impression is recorded provides a cuff of material below the finish line thick enough to avoid tearing on removal. Very thin cuffs of material are prone to distortion and as a rule of thumb should be >0.15 mm [8].

A complication of any packing technique is subsequent unwanted gingival recession exposing a restoration margin, particularly in the anterior region. Fortunately, for most patients the amount of recession is small (around 0.25 mm after 2 months) and generally not of clinical significance [9], but in susceptible patients a marked recession is sometimes seen in just a few weeks, emphasising the need for gentle

Box 21.1: Gingival Retraction Using Cord with Ferric Sulphate Solution

- Ensure adequate isolation and moisture control—a flanged salivary ejector is needed for impressions of lower posterior teeth.
- Consider need for electrosurgery (either "troughing" or gingivectomy or both) in combination with the one- or two-cord technique. If gingival inflammation needs to be resolved, temporise with well-fitting margins.
- Soak cord in ferric sulphate solution (15.5% w/v) and pack.
- Apply further solution using syringe applicator or pledget of cotton wool (beware—solution tastes foul).
- After 5 min wash cord well and remove carefully so that lining of sulcus is not stripped out causing bleeding.
- Continue to wash prep with atomised spray and dry well, especially the more inaccessible parts of the preparation. The inner aspect of the sulcus will often appear black with stabilised coagulum. Remove any coagulum adhering to tooth preparation or finish line.
- Only start mixing the impression if the gingivae are adequately retracted and dry.
- If bleeding starts, reapply ferric sulphate solution and repack with soaked cord for a further 5–10 min before reattempting impression.

handling of the tissues. With the two-cord technique this risk can also be minimised by selecting a small diameter for the first cord and the next size up for the second cord. Advice on packing technique is covered in Box 21.1. To be effective, leave cords in place for 5 min but not much longer than 10 min to minimise risks (see Table 21.1). The risk of bleeding on cord removal can be reduced by washing beforehand with a water spray and then removing the cord from the sulcus whilst still wet (see Box 21.1). Always check all cords have been removed before dismissing a patient.

21.3.2 Medicament Pastes

These viscous pastes (Table 21.1) which are syringed into the gingival sulcus provide a convenient, non-cord method of gingival retraction. Some rely simply on applying pressure to the area (e.g. with a polysiloxane foam), whilst others contain an astringent (e.g. aluminium chloride). Clinically, they do not offer as wide a range of applications as retraction cord, particularly for subgingival preparations. However, a systematic review has advised their use for equi-gingival finish lines where the tissues are thin and likely to be traumatised by cord placement [10].

21.3.3 Surgical Techniques

Electrosurgery and soft tissue laser are two methods of creating a fine gutter or trough 0.2–0.5 mm wide around a subgingival finish line (Table 21.2). These techniques both remove a thin layer of soft tissue from the inner aspect of the gingival cuff. Rotary curettage also removes tissue from the inside of the cuff but does not create a clearly defined trough beneath the finish line. Inevitably bleeding may occur, particularly with rotary curettage but less so with electrosurgery and laser. So, supplemental use of cords and medicaments is best anticipated.

Electrosurgery is currently more popular than laser; one study reporting 32% of dentists using it compared with 20% using laser [4]. Despite there being some contraindications to using electrosurgery (see Table 21.2), it is remarkably useful but surprising that it has not been adopted by more dentists.

Once mastered, the electrosurgery tip can be directed around sections of the sulcus in a smooth sweeping motion for each cut. Take care not to penetrate more than 1 mm into the sulcus or to return to the cut area for at least 10 s. This is to prevent a damaging heat build-up in the tissues which may cause unwanted recession, particularly in thin gingival tissues.

To avoid soft tissue burns use plastic mirrors/retractors, and check integrity of the electrode tip insulation. Similarly, do not touch against metal restorations which causes unwanted arcing and pulp damage. Be cautious not to cause localised bony necrosis as may occur after touching the electrode against exposed bone or implants or metallic implant abutments. Be aware there is a small risk of causing skin heating if the collecting electrode contacts metal rings, fasteners, buckles, etc. Further technique detail can be found elsewhere [11].

There is some limited review data supporting electrosurgery and laser surgery to assist with gingival retraction. However, comparisons between them are impossible because measurements of the trough and subsequent gingival response were not standardised but clearly need to be for future studies. Nevertheless both techniques, in common with other retraction methods, normally show rapid healing of the gingival sulcus with signs of inflammation unusual beyond 2 weeks [6].

Despite the paucity of trial data, there is no doubt that electrosurgery and lasers, when used with care, are invaluable for dealing with difficult subgingival margins and other tissue retraction issues.

21.4 Other Retraction Issues

21.4.1 Retraction Cord Displacement from the Sulcus

How frustrating when gingival tissue conspires to eject the cord from the sulcus almost immediately after placement. Healthy gingival tissue can sometimes be very tightly bound to the tooth adjacent to preparations. Rather than inflict trauma from brutally packing retraction cord, consider using electrosurgery or a laser to

create a trough. This may be sufficient, but if there are issues with haemostasis, a single cord with ferric sulphate solution can then be gently packed. If the gingival tissue biotype is thin, electrosurgery and laser troughing may result in recession. Instead we advise either a small diameter cord packed carefully with a sustained, controlled force or, as already mentioned, the use of a syringed medicament paste.

21.4.2 Localised Gingival Overgrowth

An ingrowth or overgrowth of inflamed gingival tissue is often seen when replacing crowns with open subgingival margins or where a crown with a subgingival margin has been lost. Anyone who has removed a poorly fitting provisional crown will know tissue invasion does not take long where a margin is subgingival (see Chap. 23). Simply using retraction cord to displace inflamed gingival overgrowth often results in frustration and failure. A better approach is to remove excess tissue with either electrosurgery or laser, and then create a sulcular trough into which a retraction cord may be placed (Fig. 21.2). If bleeding still prevents taking an impression, the finishing line is usually sufficiently clear to make a well-fitting provisional restoration Fig. 21.3.

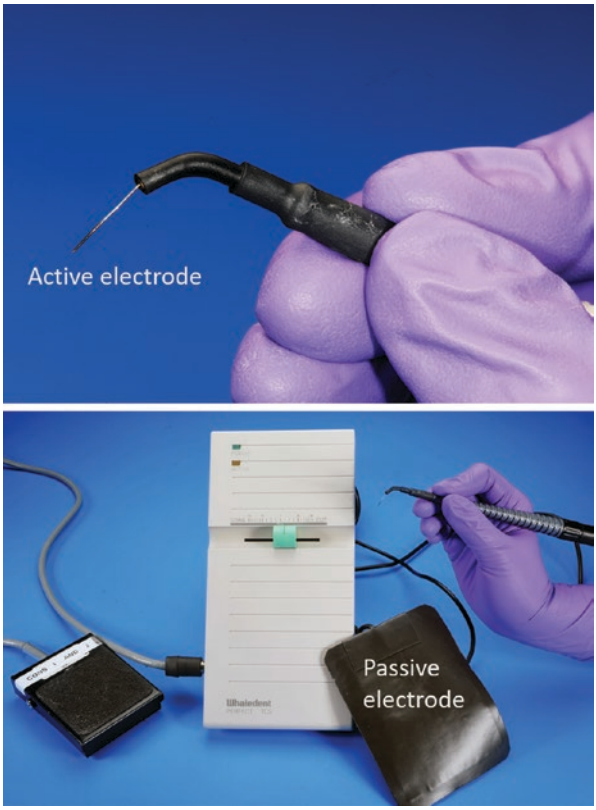

Fig. 21.2 An electrosurgery machine with a fine wire active electrode and the "passive" collecting electrode which can be placed under the patient's shoulder. The green slider controls the current: Either cutting (for troughing) or coagulating (occasionally used for haemostasis)

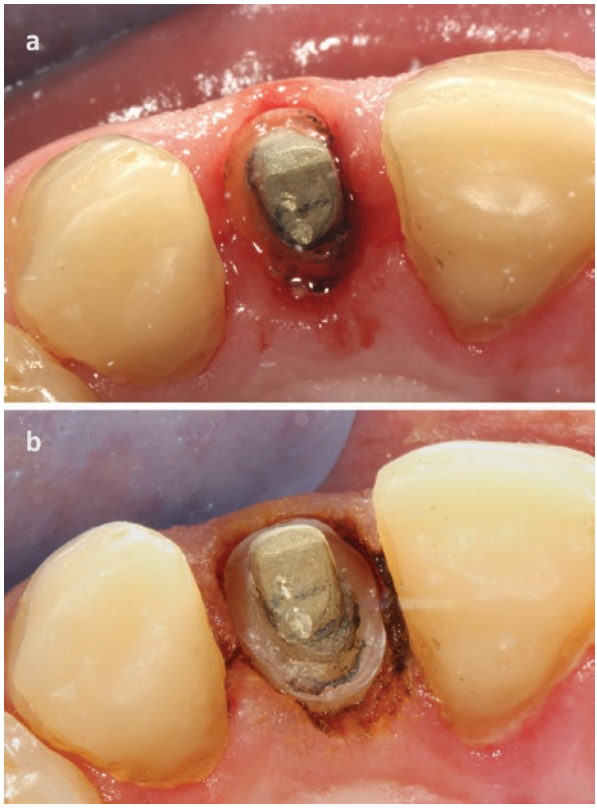

Fig. 21.3 Gingival electrosurgery: Overgrown gingivae requiring removal prior to impression (**a**) Tissue excision on palatal and mesial aspects followed by the creation of a small trough for the retraction cord to sit (**b**) Haemostasis achieved with ferric sulphate solution

Conclusion

Successful restorative dentistry requires good gingival management both prior and during the preparation appointment. Elimination of existing inflammation and allowing the gingivae time to stabilise helps create a frame for fine restorations, particularly where equi-gingival or subgingival margins are planned. Dentists should be familiar with a range of gingival retraction techniques, including their indications, contraindications, and potential hazards. Most dentists still use retraction cords and medicament solutions for gingival retraction but may wish to consider using electrosurgery or laser for more difficult cases. Sufficient time should be allocated during the impression appointment to allow for a gentle cord placement technique, adequate retraction, and complete haemostasis. If bleeding prevents an impression being recorded, make a further appointment in 3–4 weeks to allow for gingival healing and try again.

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