Contents

8 Biological impressions

Introduction

Shavell coined the phrase 'biological impressions', to signify impressions that capture, with fidelity, healthy tissues in their natural habitat.[1] Most indirect dental restorations are made with only an impression as the unifying element linking the three protagonists, ceramist, patient and dentist (or CPD) (Fig. 8.1). The intrinsic qualities of an impression are to record as much and as accurate detail as possible. This necessitates faithfully recording the prepared, adjacent and opposing dentition, together with the surrounding soft tissues. Whether an impression is for a laminate, inlay, crown, bridge, denture or implant, the objective is to reproduce accurately a facsimile of anatomical structures as a morphological platform for fabricating the proposed restoration. This implies that the tissues are neither escharotic nor necrotic.

Two types of biological impressions are required: dental and gingival. The dental biological impression is one that replicates abutment teeth following preparation. By definition, this requires deflecting the gingival crevice to accommodate an impression material that will reproduce the preparation margins for obtaining a correct emergence profile. The gingival biological impression records the periodontium in a non-deflected state. The latter is made after fabricating the definitive restoration, at the try-in stage, when the gingival tissues have recoiled to their normal position. By locating the restoration on an untrimmed plaster model, the rendezvous of a restoration with the surrounding soft tissues is visualised. This allows assessment of the cervical transmucosal soft tissue support and contact points. Following modifications, a non-violent coexistence between the two entities, restoration and soft tissues, is achieved.[2]

SCIENTIFIC RATIONALE

Making precise impressions depends on two variables, the primary and secondary determinants. While there is only one primary determinant, without which an accurate impression is unattainable, there are numerous secondary determinants, which are discussed initially,

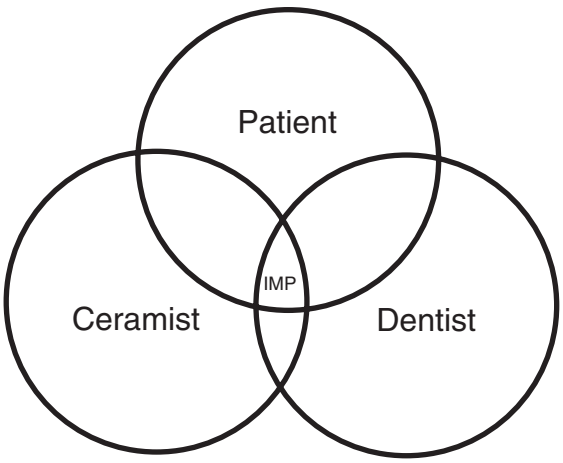

Figure 8.1 The impression is the key element linking ceramist, patient and dentist.

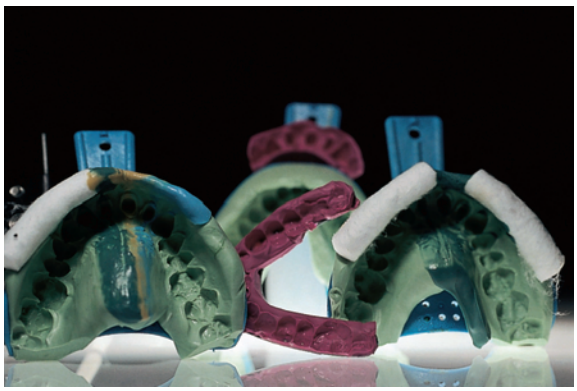

Figure 8.2 Rigid plastic stock trays are satisfactory for making impressions for up to three units.

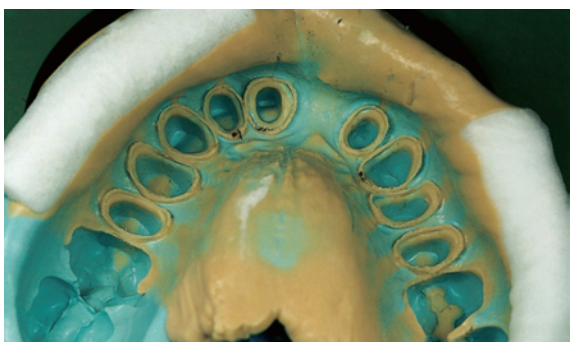

Figure 8.3 Full maxillary intra-arch impression.

before considering the crucial primary determinant.

Secondary determinants

The following list is not exhaustive, but emphasises pertinent points of the secondary determinants.

Stock vs. custom trays

The rationale for using custom or special trays is to control dimensional stability, and hence minimise polymerisation shrinkage. This was particularly significant with earlier elastomeric materials, but is less relevant with contemporary formulations. The newer materials are relatively stable, exhibiting sufficient stiffness and rigidity. The advantages of custom trays are ease of location and seating in the oral cavity, patient comfort by avoiding sharp tray flanges impinging into the sulci, and capturing posterior teeth without the need to modify stock trays with wax or compound materials. As a general guideline, stock trays are acceptable for one to three units in conjunction with a heavy-bodied or putty base (Fig. 8.2).

Inter- vs. intra-arch

Intra-arch impressions record an entire arch including contralateral teeth (Figs. 8.3–8.6), while inter-arch impressions record the antagonist dentition. The latter is carried out using 'triple trays' and benefits include eliminating an opposing arch impression and bite registration. While the resulting impression records both the prepared teeth and occlusal registration, the technique is trying for both the clinician and ceramist. Furthermore, inter-arch impressions

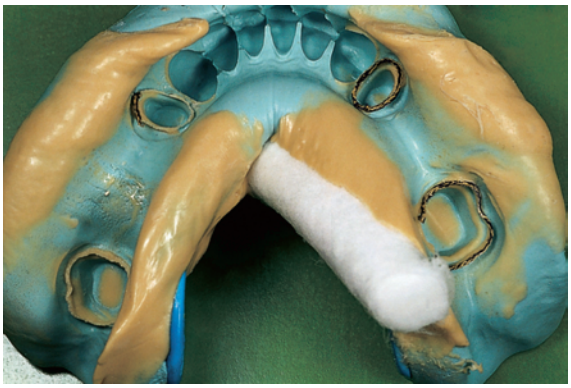

Figure 8.4 Full mandibular intra-arch impression.

Figure 8.5 Trimmed dies from maxillary intra-arch impression in Figure 8.3.

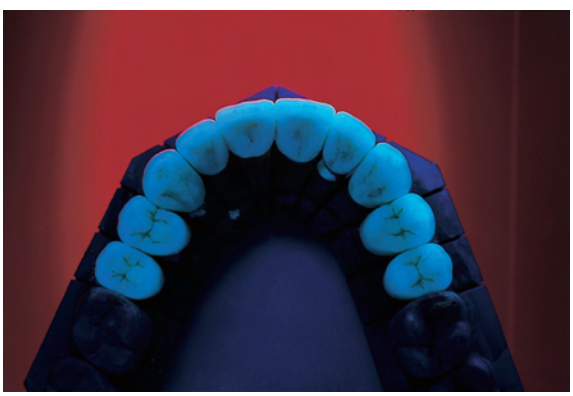

Figure 8.6 Completed crowns for patient in Figure 8.5.

are limited to one or two units. Further disadvantages include distortion of tray when the patient occludes,[3] verifying whether the teeth are in centric occlusion, and ensuring that at least two teeth either side of the prepared abutment are included.

If, however, the tooth to be restored has interferences (working or non-working side), or is the initial contact in CR or a guiding tooth, interarch impressions are essential to allow mounting on a semi-adjustable articulator.

Closed vs. open tray

The rationale for an open tray is that drilled holes in the impression tray act as vents for excess material and air to escape. In theory, this is valid, but clinically there is little improvement of the resulting impression. Furthermore, since excess material has to be rapidly mopped after tray insertion, there is increased patient discomfort, often eliciting a reflex gagging response.

One vs. two stages

The basis of a two-stage impression is ensuring a solid platform for the subsequent wash stage. The procedure involves taking an initial impression with putty (using a rigid metal or stock tray), usually separated by an acetate or polypropylene sheet, in effect, to form a custom tray. The second stage is injecting a light-bodied wash over the prepared teeth and reseating the tray. The obvious disadvantages are incorrect tray location, lengthy procedure and protracted endurance for the patient. The advantage of the one-stage impression is expediency and guaranteed correct seating, but timing is critical. The wash must be placed simultaneously on to the abutment while the assistant mixes and loads the putty or heavy-bodied material. In addition, once mixed, the tray must be inserted immediately to prevent the material reaching the elastic stage, which can flex the tray (if plastic) and produce distortions.[4]

Passive vs. non-passive

Most elastomeric materials recoil after the tray is removed from the mouth. A non-passive impression made by continuously applying pressure to the tray while the material is setting, causes pronounced recoil, with the detrimental manifestation that the crown fits the plaster die, but not the intra-oral abutment. To circumvent the latter, once the tray is correctly seated, pressure is relieved, allowing the material to set passively. Since the material polymerises without external pressure with a passive impression, post-removal recoil is significantly reduced.[5]

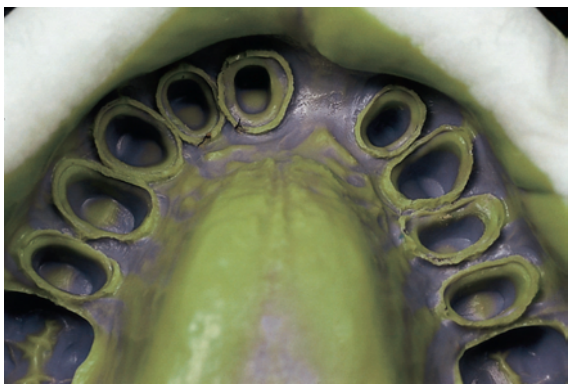

Figure 8.7 Flexitime (Heraeus Kulzer) full maxillary arch impression.

Warm vs. cold environment

When attempting impressions for multiple units, a prolonged working time is clearly desirable. Chilling an impression material facilitates this, but increases the viscosity with possible alteration or retardation of the material setting reaction. Recently, a new impression material has been introduced, Flexitime (Heraeus Kulzer, Hanau, Germany), which facilitates a variety of clinical situations. Because the setting reaction is initiated by the warm oral ambient temperature, polymerisation only starts when the material is placed in the mouth. The working time ranges from 30 seconds to 2½ minutes, but setting is always 2½ minutes after tray insertion, allowing impressions of single as well as multiple preparations (Fig. 8.7).

Manual vs. automated mixing

Using mechanical or automatic mixing equipment ensures a homogenous, void-free mix, greatly enhancing the quality of the final impression. A variety of materials, including polyethers and addition silicones, are available in cartridges for these machines. The only drawback is the initial capital outlay for equipment purchase.

Figure 8.8 Retraction cord being placed around prepared teeth.

Physical vs. chemical gingival retraction

Physical retraction of the gingival crevice involves using retraction cord(s) (Fig. 8.8). This is an effective and predictable method for achieving transient opening of the sulcus, allowing an impression material to record the preparations' margins (Fig. 8.9). In addition, gingival retraction is less traumatic than electrosurgery or rotary gingival curettage, with diminished chances of ensuing gingival recession.[6,7] However, excessive pressure during cord placement may inadvertently damage the delicate epithelial lining of the crevice or violate the biologic width.

Figure 8.9 Retraction cord in situ to deflect gingival crevice and act as a physical barrier protecting the biologic width.

Another concern with retraction cords is using haemostatic agents. Recent research concludes that using the commonest haemostatic agents, such as racemic epinephrine, aluminum sulphate, aluminum chloride, aluminum potassium sulphate or ferric sulphate, has no effect on setting reactions of polyvinyl siloxanes (addition silicones).[8] Additionally, aluminum chloride is effective for achieving chemical and mechanical tissue displacement,[9] whereas epinephrine causes local necrosis and possible unwanted systemic side effects.[10]

A recently introduced chemical retraction agent (Expasyl, Kerr) combines aluminium chloride and kaolin. The aluminum chloride acts as the astringent, while the hygroscopic kaolin expands once in contact with crevicular fluid for achieving the desired gingival deflection. Whilst circumferential enlargement of the sulcus is achieved, subsequent removal of the material by rinsing can be problematic. Lastly, chemical retraction alone does not offer a physical barrier, as with retraction cords, for safeguarding the biologic width.

Impression materials

The dental market is awash with impression materials and selection depends on the intended use of the impression. Irreversible hydrocolloids may be acceptable for diagnostic or opposing arch impressions, but are inappropriate for precision-fabricated restorations. The properties of five commonly used impression materials for prosthodontics are summarised below and in Table 8.1.

Definitions

- Tear resistance – ability of an impression material to resist tearing in small cross sections, especially intra-sulcular areas
- Elastic recovery – the degree of recoil of a material without permanent elastic deformations, e.g. from a tooth preparation undercut
- Dimensional stability – ability to withstand stress without permanent deformation, e.g. a heavy-bodied or putty formulation

Reversible hydrocolloids

A decade ago, reversible hydrocolloids were the vogue. These materials are hydrophilic, allowing impression making in a relatively moist environment, and extremely accurate with good tear resistance. However, due to poor long-term stability, immediate pours are mandatory. In addition, a custom tray and heating/cooling apparatus are required, prolonging clinical time with additional procedures. Another factor is that multiple pours may not be feasible, and these are necessary for most contemporary all-ceramic restorations.

Polysulphides

Polysulphides were the first elastomeric impression materials, with excellent tear resistance, ideal for capturing subgingival crown margins. However, inferior elastic recovery necessitated immediate pours, while poor dimensional stability mandated using custom trays, both affecting the accuracy of the impression.

Table 8.1 Properties of popular impression materials.

Property	Reversible hydrocolloids	Polysulphides	Condensation silicones	Polyethers	Addition silicones
Tray	Custom	Custom	Custom/stock	Custom/stock	Custom/stock
Handling	Specific equipment necessary Multiple pours?	Soft	Soft	Rigid, unpleasant taste Multiple pours?	Soft, multiple pours possible, avoid latex gloves,[11] and acrylic monomers
Hydrophilic	Yes	No	No	Yes	No
Tear resistance	Good	Good	Poor	Good	Average
Elastic recovery	Average	Average	Good	Good	Good
Long-term stability	Poor	Poor	Poor	Good	Good
Disinfection	Non-water soluble	Water soluble (e.g. NaOCl)	Water soluble (e.g. NaOCl)	Non-water soluble	Water soluble (e.g. NaOCl)
Immediate pour	Yes	Yes	No	No	No
Accuracy	Good	Average	Average	Good	Good

Condensation silicones

These materials have enhanced elastic recovery compared to polysulphides, but suffer from poor tear resistance (Fig. 8.10). Hence, recording subgingival margins is trying and often results in torn material left in the gingival crevice, yielding inaccurate margins.

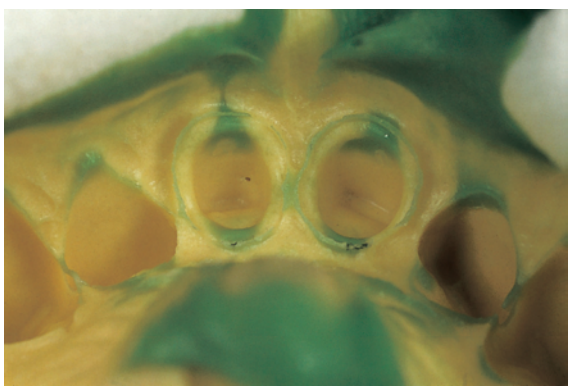

Figure 8.10 Condensation silicone impression (Optosil, Xantopren, Heraeus Kulzer).

Polyethers

Polyethers have superior tear resistance compared to condensation silicones, with excellent dimensional stability and accuracy. Another benefit is the hydrophilic property, allowing impressions to be made in relatively moist conditions. Initially, polyethers were unavailable in a heavy body, but newer formulations have putty components, obviating the need for using a custom tray. Another disadvantage was rigidity, making removal from undercuts extremely difficult, e.g. locking into gingival embrasures around periodontally compromised teeth. This limitation is also significant if multiple pours are necessary, since material rigidity causes breakage of plaster casts upon removal of the impression. The latest generations are 'soft polyethers' for increased patient comfort, and ease of

retrievability from the mouth (Fig. 8.11). Newer versions are also insipid, eliminating the undesirable taste of older polyethers.

Polyvinyl siloxanes (addition silicones)

The most ubiquitous impression materials currently used for prosthodontics are the addition silicones. The large number of viscosities (Figs. 8.12 & 8.13) makes these materials extremely versatile for many clinical situations (Figs. 8.14–8.19). The beneficial properties are excellent elastic recovery, dimensional stability, the materials are tasteless and relatively soft (allowing removal from undercuts), stock or custom trays can be used and there is good detail

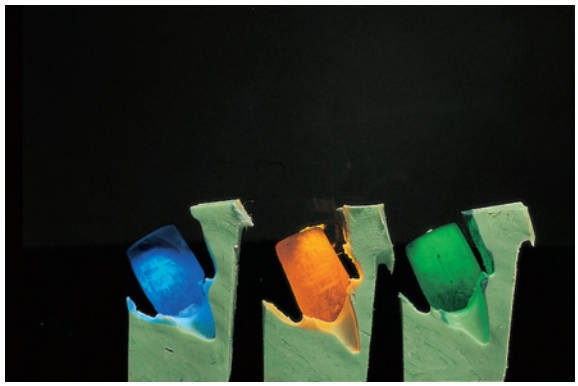

Figure 8.13 Sectioned impression and dies using three addition silicone viscosities for patient in Figure 8.12.

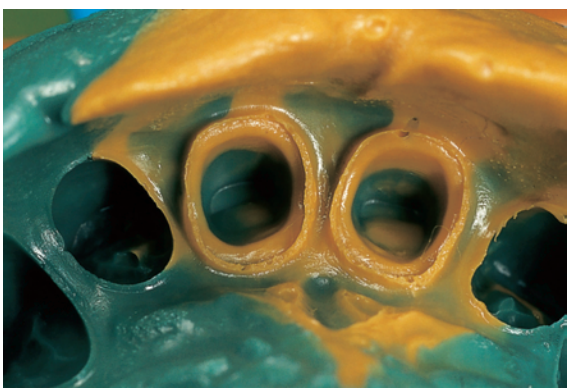

Figure 8.11 Polyether impression (P2, Heraeus Kulzer).

Figure 8.14 Use of addition silicones: implant-supported restorations.

Figure 8.12 Addition silicones are available in a variety of viscosities: monophase, medium and light-bodied consistencies.

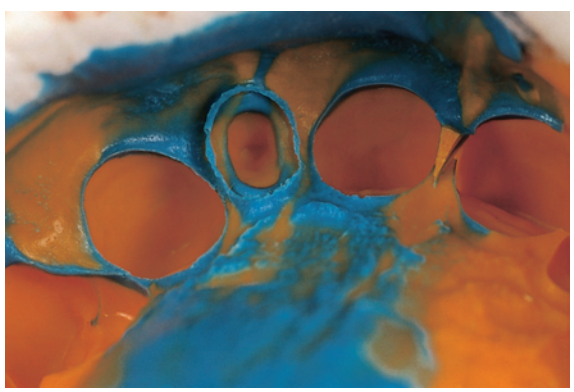

Figure 8.15 Use of addition silicones: single units.

Figure 8.16 Use of addition silicones: indirect post/cores.

Figure 8.17 Use of addition silicones: multiple units.

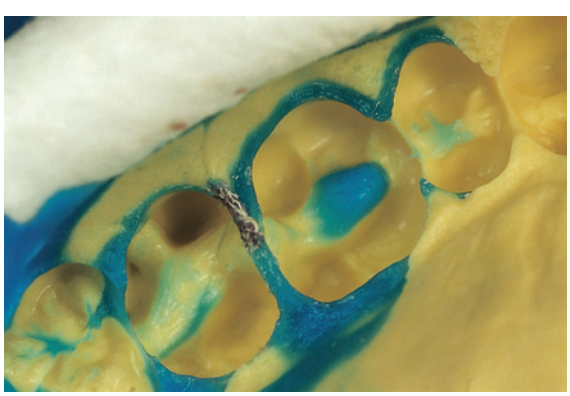

Figure 8.18 Use of addition silicones: porcelain inlays.

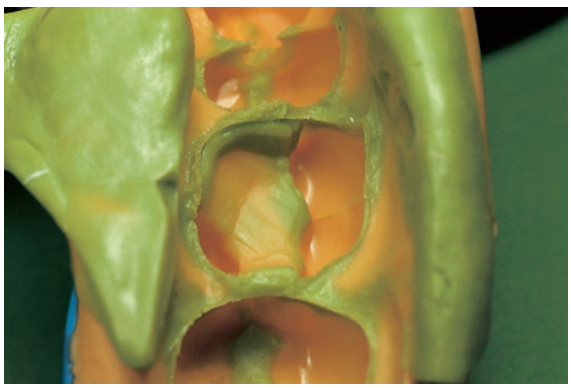

Figure 8.19 Use of addition silicones: porcelain onlays.

reproduction (accuracy). The tear resistance of addition silicones is less than that of polysulphides. However, a balance is necessary. The high tear resistance of polysulphides, but poor elastic recovery, means that although the material will not tear, it will permanently deform. Conversely, the addition silicones have good elastic recovery and lower tear resistance, meaning that the material will tear before permanent deformation. The latter is crucial for accurately reproducing prepared abutments. These properties are a major reason for their popularity for contemporary dental procedures.[12] The main disadvantage is that polyvinyl siloxanes are intrinsically hydrophobic, but the recently introduced Provil novo (Heraeus Kulzer, Hanau, Germany) claims to be 'hydroactiv', by initially 'wetting' the abutment tooth, thereby overcoming the stringent arid environment necessary for addition silicones.

Primary determinant

The above discussion has focused on the secondary determinants influencing an accurate impression. However, even if all these factors are optimally prevalent, absence of the primary determinant makes an accurate impression elusive. The single factor, which is quintessential for a precise impression, is attaining and

Figure 8.20 Achieving periodontal health: pre-operative defective crowns.

Figure 8.22 Achieving periodontal health: post/core build-up. Following tooth preparation and temporarisation, the gingiva is stable and healthy, ready for impression making.

Figure 8.21 Achieving periodontal health: crown removal.

maintaining periodontal health; this is termed the primary determinant (Figs. 8.20–8.22). The period for gingival healing varies enormously from 3–21 days, and is influenced by patient and operator factors.[13]

Patient factors (risk assessment)

- Genetic predisposition
- Age
- Gender, e.g. pregnancy, osteoporosis
- Race
- Systemic illness, e.g. diabetes, compromised immune system, psychological stress[14]
- Dental biotype and bioform
- Type of oral pathogens
- Local trauma, or previous pathology with compromised vascularity, e.g. periapical lesions
- Socio-economic status
- Oral hygiene
- Local irritants, e.g. smoking, tobacco or betel nut chewing

All the above factors are beyond the clinician's control, and first nine are beyond the patient's control.[15] Although unchangeable, these risk factors should be borne in mind since these affect the rate of healing and may necessitate revising the proposed treatment plan (see discussion on risk assessment in Chapter 1). For example, an elderly patient, with systemic ailments, will have a protracted healing time. Also, a thin scalloped biotype will negate extensive soft tissue manipulation for fear of gingival recession, especially in aesthetically sensitive areas. Finally, low socio-economic status patients may not regard dental care a priority, and proposing sophisticated treatment modalities may be futile because of a high risk of failure (poor compliance and maintenance).

The last two items, oral hygiene and local irritants, are the only two factors that a patient can change, and which the clinician can influence by oral health education, emphasising the importance of maintaining a natural dentition.

Operator factors

- Prevention and prophylaxis, e.g. scaling and polishing
- Biologic width integrity
- Correct emergence profile
- Atraumatic clinical protocols, e.g. non-haemorrhagic procedures, calculated and precise tooth preparation, accurate impressions and cementing techniques
- Therapeutic temporary restorations

The operator factors are entirely controllable by clinical decisions and protocols, influencing whether or not periodontal health is achieved and maintained.

Prophylaxis

Scaling, polishing or root planing, with or without pharmaceutical adjuncts, are the first prerequisites for achieving periodontal health. Often, these vital procedures are either omitted or ignored, due to the overwhelming desire for commencing treatment. A little time spent at the start is not only beneficial for long-term oral health, but expedites all ensuing clinical stages. An adequate time following thorough prophylaxis is necessary to assess home oral hygiene measures and verify gingival health (Figs. 8.23–8.26). This also confirms the patient's responsibilities and commitment to the proposed treatment. If, however, compliance during this phase is poor, the treatment plan may require

Figure 8.23 Pre-operative calculus and plaque deposits.

Figure 8.24 Post-operative after scaling and oral hygiene instruction of patient in Figure 8.23.

Figure 8.25 The left anterior mandibular teeth have been scaled, showing gingival health (pink colour, stippling, knife-edge FGMs). Compare with the right side, which has deposits and inflammation.

Figure 8.26 The anterior mandibular and left maxillary teeth have been scaled. Compare with the right maxillary teeth, which have calculus and periodontal inflammation.

modification to less sophisticated options, in order to avoid disappointments at later phases of treatment.

Biologic width integrity

The biologic width is discussed in Chapter 2, and is nature's way of protecting the two essential elements which ensure the survival of a tooth: the alveolar bone and the periodontal ligament. If these are compromised, the survival of the tooth is jeopardised. A shield is obviously only effective when intact. If damaged or destroyed, its function is reduced or nullified. Hence, any insult to this shield, bacterial or iatrogenic, diminishes its ability to fulfil the intended function. Clinical procedures potentially hazardous to the biologic width are retraction cord placement, tooth preparation, impressions, location of crown margins and cementation. Therefore, any restorative procedure either should be supragingival, or confined to dimensions of the gingival sulcus for respecting biologic width dimensions.

If location of the crown margins is subgingival, it is necessary to verify the crevice depth, so that impression procedures do not violate the epithelial attachment. Chapter 2 discussed the rationale for either using the alveolar bone crest (ABC), or a healthy free gingival margin (FGM) as a reference point. If the ABC is used as a landmark, the sulcus depth must be verified. Measuring pocket depths with a periodontal probe is inaccurate, because it is often difficult to assess the position of the probe tip, which may have penetrated beyond the crevice base into the epithelial or connective tissue attachments. The probe depth also depends on the force applied, tooth and probe angulations and prevalent inflammation. The ideal method to determine sulcus depth is to sound bone around an anaesthetised tooth and measure the entire dentogingival complex. Assuming ideal tooth anatomical variables, a mid-facial reading of 3 mm indicates a sulcus depth of 1 mm (entire dentogingival complex = 3 mm, minus 2 mm for biologic width = 1 mm sulcus depth). An interproximal measurement of 5 mm, indicates a 3 mm sulcus depth (entire dentogingival complex = 5 mm, minus 2 mm for biologic width = 3 mm sulcus depth).

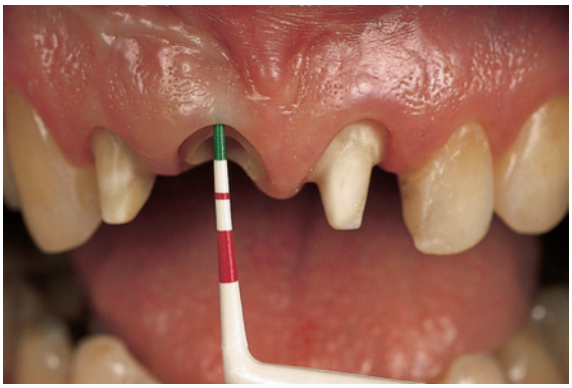

Figure 8.27 Periodontal probe measuring sulcus depth, using a healthy FGM as a reference point.

Alternatively, if the FGM is used, the crown margins should be placed 0.5 mm within the sulcus from the most apical zenith of the FGM, coronal to the epithelial attachment (Fig. 8.27). It is evident that whichever landmark is used, ABC or FGM, the margins are located coronal to the epithelial attachment. Similarly, the impression procedures are also limited to the dimensions of the sulcus.

Another factor to consider is the periodontal biotype, e.g. a thin, scalloped biotype will predispose to gingival recession, while a thick, flat biotype predisposes to periodontal pocket formation or persistent inflammation.[16] For anterior restorations, delicate tissue manipulation is necessary with thin scalloped biotypes for avoiding gingival recession, which could compromise aesthetics.

Emergence profile

The emergence profile of a crown is the junction of its cervical aspect, which meets the prepared tooth margin (Fig. 8.28).[17] An ideal emergence profile is attained when the crown and tooth margins meet at a tangent. Or, put another way, the crown margin lies at 180° to the root surface, apical to prepared tooth margins, ensuring that the crown is neither over- nor under-contoured. If the TTR was correctly fabricated, gingival health should be apparent. If the FGM is blanched or flaccid and unsupported, the gingiva

Figure 8.28 Emergence profile: sagittal view of a crown silhouette showing that its margins are on a tangent with the root apical to the finish line.

Figure 8.30 Atraumatic clinical protocol: pre-operative defective crown on left maxillary lateral.

Figure 8.29 Gingival inflammation around incorrectly contoured temporary crown on left maxillary canine.

Figure 8.31 Atraumatic clinical protocol: retraction cord in sulcus and crown removal.

will be inflamed, and this requires resolution before biological impressions are attempted (Fig. 8.29).

Atraumatic clinical protocols

Following prophylaxis and achievement of periodontal health and stability, all clinical procedures should be performed atraumatically, minimising soft and hard tissue damage. These include crown removal, tooth preparation, retraction cord placement, impression making and cementation.[18] Ideally, whenever possible, a non-haemorrhagic approach is adopted, with the rationale that minimising trauma during treatment not only accelerates the healing process, but also helps maintain existing health (Figs. 8.30–8.34).

Therapeutic temporary restorations

A detailed explanation for fabricating temporaries is outlined in Chapter 7. To summarise, a temporary restoration should respect the biologic width, have a correct emergence profile and act as a template for the definitive restoration (Fig. 8.35). The fruits of these labours are realised when attempting impressions. Meticulous attention to detail during fabricating, adjusting and maintaining a temporary prosthesis results in optimal soft tissue health, a prerequisite for both dental and gingival impressions.

Figure 8.32 Atraumatic clinical protocol: refined cast metal core using a haemorrhage-free protocol.

Figure 8.35 Chairside temporary acrylic crowns on teeth #12, 11 and 21, which will be adjusted and used as templates for the final restorations.

Figure 8.33 Atraumatic clinical protocol: definitive crown-to-tooth preparation relationship.

Figure 8.34 Atraumatic clinical protocol: cemented definitive crown.

CLINICAL PRACTICE

Once the primary determinant, gingival health, is attained and maintained, biological impressions are contemplated. Two types are required, the dental and gingival biological impressions.

Dental biological impressions

The dental biological impression is for recording the prepared tooth margins. To achieve this, gingival retraction using the double cord technique is necessary for exposing the preparation margins, maintaining an arid environment and accommodating an adequate bulk of impression material.[19] In order to avoid distortion of the impression material a minimum sulcus opening of at least 0.2 mm is required,[20] and typically, a gingival deflection of 0.3–0.4 mm is routine.[21] Finally, it is necessary to record the apical part of the root beyond the preparation margins, allowing the ceramist to construct a correct crown emergence profile. The double cord technique is shown in Figure 8.36. The first thin cord (Ultradent # 000) is delicately introduced into the sulcus to vertically retract the gingiva apically, and maintain a dry field by absorbing the crevicular fluid. This cord should disappear into

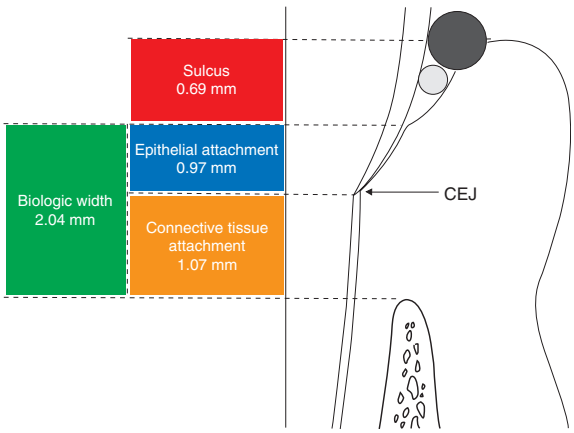

Figure 8.36 Double retraction cord technique.

the sulcus and be invisible from the facial aspect. The second thicker cord (Ultradent # 1), pre-impregnated with an astringent, e.g. buffered aluminium chloride, is introduced to half its width to transiently horizontally (laterally) open the gingival crevice. Instead of using a pre-impregnated cord, a dry cord can be placed into the sulcus, and then dabbed with astringent, which swells the cord and dilates the crevice. After 5 minutes, the second cord is removed, while the first stays in situ. An impression is now possible to record the preparation margins, and an apical part of the tooth beyond the finish line (Figs. 8.37 & 8.38).

To ensure predictable and consistently accurate impressions, the following sequence is necessary:

(1) Establish presence of primary determinant, i.e. gingival health
(2) Choose appropriate secondary determinates:
- Stock tray for up to three units, custom tray for more than three units
- Full intra-arch impressions
- Avoid excessively large holes in trays, minimising intra-oral excess material spillage (or use closed-tray technique)
- One-stage technique
- Passive setting of impression material
- Avoid chilling impression material
- Use automixing units
- Use either retraction cord as a physical barrier in sulcus or chemical retraction
- Use either polyether or addition silicone materials for convenience, expediency and accuracy

(3) After tooth preparation (Fig. 8.39), seal exposed dentine tubules, mitigating post-operative sensitivity[22] using either a sixth or seventh generation self-etching DBA[23] or a fifth generation DBA by etching, priming and sealing. To avoid interaction of the oxygen inhibition layer with acrylic monomer and impression materials, light-cure the bonding agent through a glycerine gel cover[24]
(4) Ascertain sulcus depth for selection of the appropriate diameters of the retraction cords. For the double retraction cord technique, both cords are placed within the dimensions of the prevailing sulcus depth. The first cord is thinner than the second cord
(5) Assuming normal anatomical relationships, the first cord is usually # Ultradent 000. Applying gentle pressure with a thin flat plastic instrument, introduce the dry cord into the friable sulcus without causing haemorrhage (Fig. 8.40) (Hint 8.1)
(6) Next, a second thicker cord, usually Ultradent # 1 pre-impregnated with an astringent, e.g. buffered aluminium chloride, is placed to half its width (Hint 8.2). This second cord should be visible from the facial aspect (Fig. 8.41) (Hint 8.3)
(7) After 5 minutes, ease second cord from the sulcus, leaving the first thinner cord in situ (Figs. 8.42 & 8.43) (Hint 8.4)
(8) Copiously apply tray adhesive to the appropriate size tray (Hint 8.5)[25]
(9) While injecting the low viscosity wash on to the prepared abutment(s) (Fig. 8.44), ask assistant simultaneously to load the heavy-body material into impression tray (Hint 8.6)
(10) After correct seating and location of the tray, relieve pressure allowing passive polymerisation of the impression materials (Hint 8.7)
(11) Once set, rapidly remove tray avoiding viscoelastic distortions of impression materi-

als. Rapid removal reduces the time the material is under stress and therefore reduces permanent distortions[26]

(12) Check impression for absence of voids and defects, and faithful reproduction of the part of the root surface apical to the preparation margins (Hint 8.8)

(13) Disinfect with appropriate antiseptic solution, e.g. glutaraldehyde or sodium hypochloride (Hint 8.9)[27]

(14) Pour impression using dental plaster/stone (addition silicones are compatible with most dental plasters for model and die fabrication) (Fig. 8.45)

(15) Addition silicones allow multiple pours for up to 1 week, and both addition silicones and polyethers can be stored in temperature ranges of 4–40°C without affecting dimensional stability[28]

(16) Take facebow and bite registrations (Figs. 8.46 & 8.47).

Gingival biological impressions

The gingival impression is for assessing the relationship between soft tissues and the artificial prostheses. This impression is essential for anterior teeth where 'pink' or soft tissue aesthetics are of paramount concern, but less relevant for

Figure 8.37 Retraction cord in situ to deflect gingival margins for recording the root surface apical to the finish line.

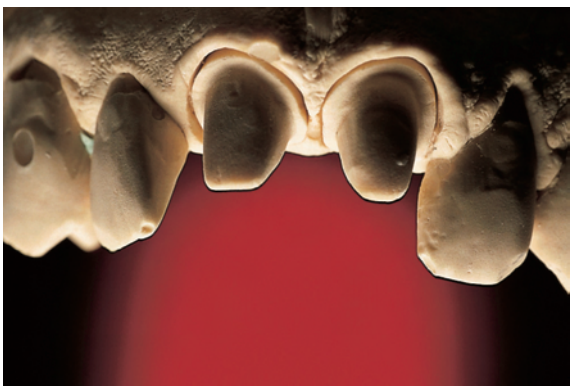

Figure 8.38 Plaster cast of impression for patient in Figure 8.37 showing that the area apical to the crown margins is accurately reproduced, which will be used by the ceramist to obtain a correct emergence profile.

Figure 8.39 Double retraction cord technique for dental biological impressions: completed tooth preparations on maxillary central incisors with a healthy periodontium.

Figure 8.40 Double retraction cord technique for dental biological impressions: the sulcus around the left central will be deflected, while that on the right central will remain undeflected for comparison. First thin, dry cord placed into the gingival crevice.

Figure 8.41 Double retraction cord technique for dental biological impressions: second thicker cord placed to half its width.

Figure 8.42 Double retraction cord technique for dental biological impressions: second cord removed after 5 minutes, leaving the first thinner cord in the sulcus.

Figure 8.43 Double retraction cord technique for dental biological impressions: retracted sulcus on left central incisor, compare with un-deflected sulcus around right central.

Figure 8.44 Double retraction cord technique for dental biological impressions: light-bodied impression material placed around preparations immediately following gingival retraction.

Figure 8.45 Double retraction cord technique for dental biological impressions: plaster cast showing accurate recording of the root surface apical to the finish line.

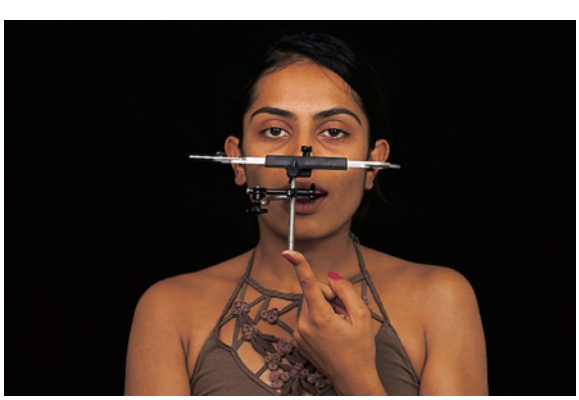

Figure 8.46 Double retraction cord technique for dental biological impressions: facebow registration for semi-adjustable articulator.

Figure 8.47 Double retraction cord technique for dental biological impressions: silicone bite registration.

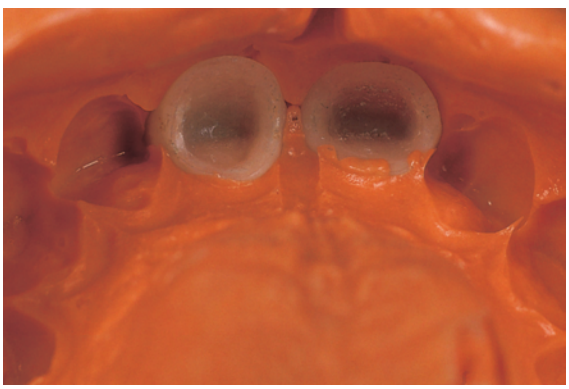

Figure 8.48 Gingival biological impressions: crowns picked up in a soft silicone impression material.

posterior extra-coronal and all intra-coronal restorations.

The gingival biological impression is made either at the bisque try-in stage of the definitive restoration, or with the TTRs (Fig. 8.48). The purpose is recording undeflected, healthy gingival architecture in a natural resting state. This allows correct interproximal contact points (Fig. 8.49), by contouring the crowns in relation to the bone crest, ideally 5 mm or less for complete papilla,[29] and ensuring ideal transmucosal support of the FGM by the cervical part of the crown, preventing a horizontally under- or over-contoured crown.

Clinically, steps for a gingival impression are similar to the dental impressions. The essential difference with gingival impressions is that retractions cords are omitted.

(1) Establish presence of primary determinant, i.e. gingival health
(2) Choose appropriate secondary determinates as for dental impressions
(3) A monophase consistency of either polyether or addition silicone is the ideal material for gingival biological impressions
(4) Ensure tooth abutment is clean and free of temporary cement
(5) Place crowns (bisque stage definitives or TTR) on to prepared abutments
(6) Copiously apply tray adhesive to appropriate size tray
(7) Mix monophase impression material and load into tray
(8) After correct seating and location of the tray, relieve pressure, allowing passive polymerisation of the impression materials
(9) Once set, rapidly remove tray avoiding viscoelastic distortions of impression materials. Rapid removal reduces the time the material is under stress and therefore reduces permanent distortions
(10) Check impression for absence of voids and defects
(11) The crowns should be picked up in the impression, if not, remove from the abutment(s) and carefully seat into impression
(12) Disinfect with appropriate antiseptic solution, e.g. glutaraldehyde or sodium hypochloride
(13) Pour impression using dental plaster/stone (addition silicones are compatible with most dental plasters for model and die fabrication or create soft tissue emulating the gingivae (Figs. 8.50 & 8.51)
(14) Addition silicones allow multiple pours for up to 1 week, and both addition silicone and polyethers can be stored at temperatures of 4–40°C without affecting dimensional stability.

Figure 8.49 Gingival biological impressions: plaster cast showing that the gingival impression records the soft tissues in a healthy, non-deflected state.

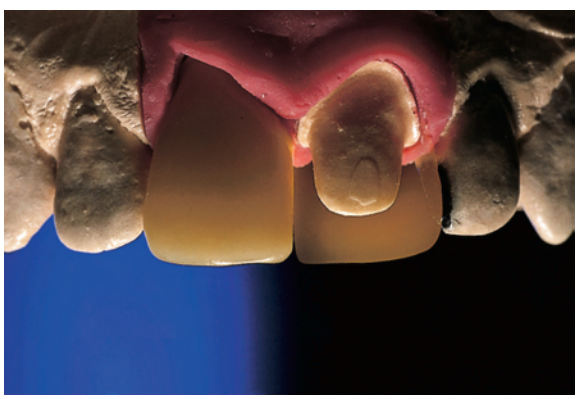

Figure 8.50 Gingival biological impressions: silicone soft tissue model to contour transmucosal part of the crown.

Figure 8.51 Gingival biological impressions: correctly contoured crowns for patient in Figure 8.50.

Hints and Tips

- Hint 8.1 – The first thinner cord should entirely disappear into the sulcus, and be invisible from the facial aspect
- Hint 8.2 – The second, thicker cord should be impregnated with the haemostatic agent 10–15 minutes before use
- Hint 8.3 – Instead of pre-soaking the second cord in a haemostatic agent, it can be placed and soaked later with haemostatic agent using cotton wool pellets. This protocol swells the cord, facilitating mechanical dilatation of the sulcus
- Hint 8.4 – Moistening the second cord with water before removal prevents unwanted haemorrhage
- Hint 8.5 – Air-drying the tray adhesive ensures tenacity, and prevents pooling which causes the adhesive to act as a lubricant rather than an adhesive
- Hint 8.6 – When mixing addition silicone putty manually, use vinyl instead of latex gloves, which retard setting reaction
- Hint 8.7 – Using a timer or stopwatch ensures precise intra-oral setting reaction, usually 3 minutes (depending on proprietary product)
- Hint 8.8 – If the first, thinner cord is picked up in the impression, loose parts can be cut with scissors. However, attempting to pull tenacious cord embedded in the impression material causes tears, leading to inaccuracies of the crown margins or the area apical to the margins; these areas are essential for creating a correct emergence profile
- Hint 8.9 – Disinfecting for 30–60 minutes results in no distortion, but long-term, overnight soaking (>18 hours) causes irreversible distortion of the impression material

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Index

C

T

U

V

W

Y

Z