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Impression making

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In this section, the clinical and technical aspects of conventional impression making are discussed and illustrated. In addition, examples of selective pressure impression techniques and functional techniques are presented.

In this part, we will discuss:

- Rationale and practice of primary impressions
- Planning of 'special' trays
- Rationale and practice of definitive techniques
- Further examples of good practice concerning teamwork

Following on from the diagnostic and preparatory phases of treatment, the impression visits provide the clinician with the opportunity to confirm the diagnosis of oral conditions and, of equal importance, to determine the likely degree of patient compliance to the treatment.

According to the *Oxford English Dictionary*, an impression is an imprint produced by 'the pressure of one thing upon or into the surface of another'. This implies an active role and not a passive role and the clinician should consider that impressions are made, not taken.

With this philosophical principle established, impression making for complete dentures may be categorised as follows:

Primary impressions

- Conventional techniques
- Template techniques

Definitive impressions

- Conventional techniques
- Selective pressure techniques
- Functional techniques
- Reline and rebase techniques (including secondary template impressions).

In this chapter, considerable emphasis is placed on impression techniques, as recent studies indicate that flawed impressions account for the majority of denture problems.¹ Two principal points to mention here are especially relevant. Lower impressions tend to be 'short' of the retromolar pads and do not accurately record the functional forms of the floor of the mouth and the retromylohyoid fossae. These deficiencies tend to result in an unstable denture. The

importance of recording the form of the floor of the mouth in relation to the mylohyoid muscle and the retromylohyoid fossae cannot be understated.

Primary impressions

Recent guidelines from the British Society for the Study of Prosthetic Dentistry (BSSPD) state that the requirements of the primary impressions are that they should accurately record clinical relevant landmarks of the edentulous mouth without excessive tissue distortion.² This implies that, by definition, the resultant impression is overextended. These guidelines also recommend the practice of using rigid stock trays, modified as necessary to 'fit the form of the denture-bearing area'. Table 1 lists the anatomical features that should be recorded.

A list of techniques will now be presented, to facilitate choice for the practitioner.

The basic function of primary impressions for complete dentures is to outline support. A secondary function is to provide the basis of a primary cast on which a customised or 'special' tray is made.

Trays for primary impressions

A large variety of trays is available for selection; some trays are metallic and have fixed handles, some are plastic with fixed or attachable handles. Although any tray could be used, consistently successful results tend to be produced when rigid trays of appropriate extension are used, especially when recording impressions of the mandibular arch (Fig. 1).

Trays for primary impressions tend to be selected from a supply of 'stock' trays which are designed to cover a broad range of arch forms

Table 1	Salient anatomical features of denture bearing areas	
Maxillary arch		Mandibular arch
i) Residual ridges, tuberosities and hamular notches.		i) Residual ridges and retromolar pads.
ii) Labial and buccal sulci. Muscle attachments and fraena.		ii) Labial and buccal sulci, muscle attachments labial to ridge and fraena.
iii) Hard palate and the functional area between hard and soft palate.		iii) Lingual sulcus, lingual fraenum, mylohyoid ridge and retromylohyoid arch.

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REFEREED PAPER
© British Dental Journal
2000; 188: 484–492

and sizes. The clinician should examine the edentulous mouth and assess the length and width of the arch to be restored. When assessing the stock trays for size, the clinician is advised to place the distal portion of the tray just distal to the posterior landmarks of the tuberosities in the upper arch, and onto the retromolar pads of the lower. This enables the clinician to visualise the width of tray required to record the functional width of the sulcus ie the tray should extend 5 mm beyond the external surface of the residual ridge.

By keeping the posterior aspect of the tray in place and rotating the anterior portion of the tray towards the labial sulcus, the clinician can determine if the tray is of an appropriate length.

Care taken at this stage will ensure that over-large trays are avoided — this will reduce patient discomfort and reduce the likelihood of the incorporation of tissue folds at this stage. Under-sized trays will result in problems for the technician making the customised trays on undersized primary casts (Fig. 2). In consequence, the clinician will experience problems as undersized primary impressions commonly result in the production of inadequate definitive impressions and these may result in support and/or stability problems in the processed denture.

Selection of impression materials

A variety of materials may be used to record impressions for complete dentures (Table 2).

These materials differ in their ability to displace soft tissues and many clinicians hold fixed views regarding the clinical effectiveness of each material. These arguments are possibly less valid in the case of maxillary impressions, where an experienced clinician may obtain acceptable results with a well selected tray and many of these materials. Figure 3 illustrates an acceptable primary impression using an impression compound and a rigid stock tray — this result should be achievable by all practitioners.

Care is required, however, in the lower arch, as a poorly chosen tray and a conventional irreversible hydrocolloid impression material may not give the acceptable result obtained with more viscous materials.

Impression technique

Conventional technique

We would urge that clinicians reject the philosophy that 'it's only the first impression', as poor primary casts do not provide a good basis for customised trays, nor do they earn the clinician the respect of the technician.

When the stock tray of appropriate size has been selected, there is merit in practising insertion of the tray; ideally the clinician should be positioned to one side and behind the patient. In addition to confirming that the tray is suit-

able for size, it allows the clinician to educate the patient on how to control his breathing during the recording of the impression.

When the upper tray has been loaded with the impression material, and the upper lip everted, the tray is held inferior and anterior to the incisive papilla. The tray is inserted upwards and backwards to fill, first of all, the labial sulcus, then the left and right sulci before the palatal area is pressed into position. The clinician may have to change the operating hand to ensure the impression material records the right and left sulci.

With lower impressions, the clinician stands to one side in front of the patient, the tray is held over the lower ridge and the loaded tray depressed, the labial, right and left sulci in turn being everted to permit the impression material to fill the functional width of the sulci.

Fig. 1 An example of rigid, appropriately extended trays for primary impressions. The benefits of trays of this form, especially in the retromylohyoid area, have been endorsed by BSSPD guidelines

Fig. 2 This slide illustrates one of the problems faced by a technician when an underextended impression has been made of the posterior lingual pouch (arrowed)

Fig. 3 Well-formed impression of (lower) lingual sulcus area

Table 2		A range of materials in common usage for impressions for complete dentures (reversible hydrocolloids are omitted because of problems of cross-infection)			
Impression material	Consistency			Type of tray recommended	Impression type- Primary (1°) or Secondary (2°)
	Viscous	Medium	Light		
Impression compound	*			Metal or plastic stock	1° (upper and lower)
Tracing stick (greenstick)		*		Customised resin	2° ; 'customises' customised tray
Compound/greenstick admix	*			Customised resin	2° (lower)
Irreversible hydrocolloid		*	*	Stock or customised	1° or 2° (upper mainly)
Modified hydrocolloid ie two-phase system	*		*	Metal or plastic stock	1° (upper and lower)
Polyvinylsiloxanes	*	*	*	Stock for putty, Customised for medium or light phases	1° if putty 2° for medium- and light-bodied phases
Polyethers		*		Customised	2°
Polysulphides		*	*	Customised	2°
Plaster of Paris			*	Customised	2° (upper)
Zinc-oxide eugenol		*		Customised	2° (lower mainly)

Figure 4 illustrates two impressions, using a two-phase hydrocolloid™ (Acudent Research and Development Co. Inc., 85 Industrial Way, Buellton, California 93427, USA), each of which clearly records the denture-bearing area. The gel of the thinner phase is syringed into the sulci and the viscous phase is located onto the tray. In each case, the denture-bearing area is outlined in indelible pencil onto the completed impression; this is to assist the technician when the customised tray is to be made. Impressions should be disinfected, in conformance to local health and safety guidelines, before being cast.

Before dispatching the primary impressions, or the primary casts if the dentist or his dental nurse has cast the impressions, the clinician should indicate to the technician the requirements of each customised tray, eg spacing, presence of handles, etc. In the case of customised trays for complete dentures, we recommend

that the technician does not perforate the trays, as this inhibits the determination of a peripheral seal (*vide infra*).

Template technique

There are occasions when either the patient wishes to have a copy made of his dentures, or the dentist elects to replicate the form of the polished surfaces of the dentures to help the patient's adaptation to the new dentures. Several clinical techniques have been advocated³⁻⁵ and they share the philosophy of fabricating a mould which contains the denture to be replicated (the template). The material investing the denture to be copied may be irreversible hydrocolloid or silicone rubber of putty consistency. When the denture is removed, wax or autopolymerising resin is poured into the mould to fill the occlusal aspects of the mould. Acrylic resin is then poured into the closed mould via inlets to fill the denture base and the replica denture prepared before definitive impressions (Fig. 5).

Definitive impressions

According to the BSSPD guidelines, definitive impressions 'should record the entire functional denture-bearing area to ensure maximum support, retention and stability for the denture during use'.

The primary purpose of definitive impressions, therefore, is to record accurately the tissues of the denture-bearing areas, in addition to recording the functional width and depth of the sulci. As has been discussed previously, there is a

Fig. 4 Two well-formed impressions using a twin-phase hydrocolloid material

need for the clinician to determine what type of impression technique is appropriate for each patient as, clearly, the condition of the tissues of the denture-bearing areas and the peri-denture tissues must influence the impression technique selected. The recording of the definitive impression is the keystone of the denture-prescribing process and the practitioner should select the appropriate technique carefully.

To avoid confusion, we shall describe a standard 'conventional' impression technique for upper and lower definitive impressions. In the interests of completeness, we shall also describe a variety of other techniques which may be grouped into the following three groups:

- Selective pressure
- Functional
- Reline and rebase impressions (including secondary template impressions).

Trays for definitive impressions

Primary casts are generally poured in dental stone and should, by virtue of the primary function of primary impressions, be slightly overextended. Depending on the presence, amount and position of undercuts the clinician should outline how much spacing is required between the tray and the primary cast, eg 3 mm spacing is recommended for irreversible hydrocolloids where large undercuts are present.

While most clinicians leave the selection of the tray material to the laboratory, the clinician should advise the technician on the form of the tray. Mention has been made already of the reason for not perforating customised trays for complete dentures prior to establishing a peripheral seal. Similarly, in order that the form of upper and lower labial sulci are not overextended, there is merit in having stub handles that will not distort the lips (Fig. 6).

Conventional impression

- After disinfection of the trays, and subsequent rinsing in water, check that each tray is adequately extended antero-posteriorly and bucco-lingually. If the trays interfere with the function of the peri-denture soft tissues, instability of the completed denture will occur if overextension is not relieved. The extent of the overextension may be determined by pressure-relief paste. Underextension may be corrected by adding tracing compound or a similar material (Fig. 7).
- Apply tracing compound to the posterior aspect of the upper tray to produce a posterior seal. The tracing compound should extend uninterrupted from one border of the tray to the other. This allows the creation of a post dam, facilitates location of the tray posteriorly and, finally, serves as a spacer for the impression material. In the lower tray, the compound should be added to displace

Fig. 5 Copy denture poured prior to modification of both the impression surface and the occlusal surface

the retro-molar pad sufficient to give a posterior seal.

- Add the tracing compound to increase the functional width of one buccal periphery (the impression material will record the functional depth). When completed, the other buccal periphery is recorded (Fig. 8). If required, the labial periphery may be moulded, although this is usually not necessary as much less resorption tends to occur in the depth of the labial sulcus. The lower tray is similarly modified.
- At this stage, the fully customised trays should exhibit good retention, a matter of confidence for both clinician and patient. Also at this stage, perforation of the upper tray may be done at the chairside, to enhance retention of, eg irreversible hydrocolloid and/or to prevent the occurrence of air bubbles being present in the palatal vault.

Fig. 6 stub handles will not distort the lower lip; any distortion is likely to alter sulcular form of the definitive impression

Fig. 7 Addition of tracing compound to a lower tray considered to be underextended distally and posteriorly

- Add a small amount of soft tracing compound or suitable material to the special trays in the region of the upper and lower canines and gently place into the mouth. These, as for the posterior placement, will serve as a spacer and prevent the incorporation of support problems by avoiding undue and uneven displacement of the impression material (Fig. 8).
- Depending on the nature of the ridges and the preference of the clinician, a variety of materials may be selected (Table 2). It is our contention that the critical components of this technique are that a stable and retentive peripheral seal will be established and that appropriate spacing is incorporated; the choice of material, within reason, is of secondary importance.
- Following loading of the tray with the material, we recommend an impression technique similar to that described for the primary impression.
- When each impression has been removed from the mouth, and checked for accuracy and form, it should be subjected to an appropriate disinfection procedure, eg hypochlorite, 1,000 ppm available chlorine.
- Before sending the definitive impressions to be cast, the clinician should carefully indicate the extent of the peripheral roll to be preserved on the master cast (Fig. 9). Given the emphasis placed on creation of the peripheral seal, it would not be desirable to lose this because of faulty master cast preparation.

Fig. 8 Tracing compound added to effect a peripheral seal. Note that some compound has been added on the areas relating to the ridge of the canine areas to act as anterior spacers

Fig. 9 Definitive impression with well-defined area for the placement of carding wax prior to boxing the impression, thereby preserving the functional width and depth of the sulci

Selective pressure impression techniques

In these techniques, three of which are described, there is a need to modify the impression procedures because of perceived support problems, eg displaceable upper anterior (flabby) ridge, fibrous (unemployed) posterior mandibular ridge or flat (atrophic) mandibular ridge covered with atrophic mucosa. While other support problems may be overcome by appropriate relief of the master cast, these conditions are best overcome by modified impression techniques. Several variations of these impression techniques occur and we have attempted to standardise them.

We recommend that the adaptation of the customised trays should be as for a conventional technique and that only after the peripheral moulding has been completed should the modifications to the trays/techniques occur. The three common clinical conditions requiring selective impression techniques are:

- Displaceable (flabby) anterior maxillary ridge
- Fibrous (unemployed) posterior mandibular ridge
- Flat (atrophic) mandibular ridge covered with atrophic mucosa.

(i) Displaceable (flabby) anterior maxillary ridge (see Part 3 Fig. 2)

After ensuring that the peripheral moulding or customising has resulted in a peripheral seal, an impression of the whole maxilla is taken using either zinc-oxide-eugenol (ZOE) or a medium-bodied polyvinyl siloxane (PVS) impression material. The former is not recommended in a patient with a dry mouth, as it tends to irritate the mucosa.

On setting, the impression is removed from the mouth and the extent of the displaceable tissue is drawn on the impression surface. This area, and the equivalent area of the tray, are then removed, using a scalpel and acrylic bur (Fig. 10a) — insertion of this modified impression and tray will demonstrate that the tray is no longer retentive.

Holding the modified tray and impression *in situ*, use a low-viscosity material (Plaster of Paris if ZOE was used, light-bodied PVS if a medium-bodied one was used) and paint or syringe these onto the displaceable tissue to record them in a minimally-displaced position. On setting, it should be apparent that a peripheral seal has been re-established.

This completed impression (Fig. 10b) should then be marked and disinfected as for a conventionally created impression before dispatch to the laboratory.

(ii) Fibrous (unemployed) posterior mandibular ridge
This condition may be recognised by the presence of a thin, mobile thread-like ridge which is essentially fibrous in nature (Fig. 11).

Fig. 10 a) Displaceable area removed from special tray. In this case, a medium-bonded PVS impression was used. b) Completed impression. Here a light bodied PVS impression material was syringed onto the displaceable tissue

The technique is shown in Figure 12a–c.

- When the customised tray has been adequately checked for peripheral extension, it is loaded with tracing compound (greenstick) and an impression of the denture-bearing area recorded.
- Using the heated spoon-end of a Le Cron carver or a similar instrument, remove the greenstick relating to the crestal tissues and perforate the tray in this region. Downward finger pressure of the modified impression, in the mouth, should elicit no discomfort.
- Inject some light-bodied PVS onto the buccal and lingual shelves of the greenstick and

gently insert the impression. Excess material will be extruded through the perforations, and the fibrous ridge will assume a resting central position, having been subjected to even buccal and lingual pressures.

The impression is now treated as for a conventionally made impression.

(iii) *Flat (atrophic) mandibular ridge covered with atrophic mucosa (Fig. 13)*

These ridges equate to Atwood's ridge orders v and vi and may be complicated by folds of atrophic and/or non-keratinised tissue lying on

Fig. 11 View of fibrous posterior mandibular ridge. This ridge as such is not useful for support

Fig. 12 a–c Staged sequence of techniques: a) Preliminary stage using tracing compound; b) Crestal area cleared of tracing compound - tray perforated on crestal area; c) Definitive impression using light-bodied polyvinyl siloxane

the ridge. McCord and Tyson described this technique which is specific for this clinical situation.⁶ The philosophy is that a viscous admix of impression compound and tracing compound removes any soft tissue folds and smoothes them over the mandibular bone; this reduces the potential for discomfort arising from the 'atrophic sandwich', ie the creased mucosa lying between the denture base and the mandibular bone.

The impression medium here is an admix of 3 parts by weight of (red) impression compound to 7 parts by weight of greenstick; the admix is created by placing the constituents into hot water and kneading with vaselined, gloved fingers.

Using a standard impression technique, the lower impression is recorded. The working time of this admix is 1–2 minutes and this enables the clinician to mould the peri-tray

tissues to give good peripheral moulding (Fig. 14).

On removal, this impression is chilled in water and then re-inserted. The operator presses on the stub handles of the tray on the premolar region and reciprocates with his or her thumbs on the inferior body of the mandible; ideally, discomfort will be felt by the patient in the area pressurised by the operator's thumbs!

Any discomfort in the denture-bearing area may be treated by adjusting the offending area of the impression with a heated wax knife and re-inserting as required until no further discomfort is felt. Alternatively, the clinician could indicate where relief is required on the master cast. This technique gives the clinician a reliable guide to the load-bearing potential of the patient's denture bearing area when making the definitive impression.

Fig. 13 View of atrophic mandibular ridge suitable for admix impression material

Fig. 14 Definitive impression

Fig. 15 Functional impression using a chairside resilient lining material

Functional impressions

These techniques may be used where problems of stability exist, either because of poor muscle adaptation and/or imbalance or because of problems of available denture space. They may also be useful in patients who have recently suffered from a stroke.

Two variations are commonly used for functional impressions.

(i) Local areas of modification

On occasion, dentures may exhibit looseness, not arising primarily from retention problems but because of localised areas of poor functional adaptation. In these cases, the application of a thin mix of a chairside resilient lining material (eg Visco-Gel, Dentsply Limited Surrey UK) may be used. The mixed material is added to the fitting surface of the denture and the patient is instructed to wear the denture for one hour. After one hour of functional moulding the denture is then removed from the mouth (Fig. 15) and the conventional relining process completed.

(ii) Problems associated with denture space/neutral zone

This technique is well documented and has been referred to as the neutral zone technique or anthropoidal pouch technique. We prefer to use the term denture form impression technique. It is designed for patients with poor track records of (lower) denture stability, a large tongue or other anatomical anomaly.

The clinical stages are standard up to and including the registration visit. After this, the upper denture is set up conventionally to the prescribed occlusal vertical dimension (OVD). Opposing the upper set-up is a resin base with three vertical stops joined by a wire bent in a sinusoidal manner (Fig. 16). The stops must contact the upper teeth at the selected OVD.

Helpful Hints

- 1 Carefully survey the denture-bearing area and select a stock tray of appropriate extension. Determine which form of definitive impression is indicated, on the basis of the nature of the supporting tissues/patient's functional requirements.
- 2 Practise the insertion of the tray to enable a) the patient to be aware of what is required in impression making and b) the clinician to be confident of his technique.
- 3 Ensure the technician is aware of the requirements for each tray (eg spacing, handles, lack of perforations, etc).
- 4 Use the impression material that works best in your hands.
- 5 If the impression material is absent over the tissue surface of the tray, a support problem will be introduced to the completed denture.
- 6 Ensure that areas that will require relief are marked on the definitive impression using an indelible pencil.

Polyvinylsiloxane putty is added to the conventional fitting surface and also to the buccal and lingual aspects of the lower base which has been coated with the requisite adhesive, and placed in the patient's mouth. Following this, the upper try-in is inserted and the patient asked to close to the OVD, swallow and carry out closed mouth exercises. These exercises provide an indication of where inward-directed forces from the buccinator muscles are equalled or 'neutralised' by outwardly-directed lingual forces ie the zone of minimal conflict (Fig. 17).

The disinfected functional impression and upper try-in are sent to the laboratory and plaster or laboratory-putty keys made of the functional impression (Fig. 18). Into these keys wax is poured to give a functional form to the polished surfaces and occlusal form of the lower denture. The technician is then required to fabricate the lower try-in and, subsequently the lower denture, to match the functional template — this will necessitate appropriate customising of the occlusal table width and possibly its length.

This procedure is clinically and laboratory technique-sensitive and competence in this technique must be shared by clinicians and technicians if a successful outcome is to be achieved.

Reline and rebase techniques (including secondary template impressions)

Irrespective of whether a conventional relined impression is being taken, or a secondary impression for the template technique, they are both definitive impressions and must be

accorded the same degree of attention as standard impression techniques.

The denture, or replica, to be relined should be modified peripherally to ensure that the peripheral seal has been established.

Undercuts are removed from the impression surface of the denture, to ensure that the master cast is not damaged on removal of the denture (Fig. 19).

Zinc oxide eugenol impression material was generally used here although clinicians now prefer to use polyether, polysulphide or polyvinylsiloxane. Before recording the definitive impression, there is merit in placing tracing compound as spacing on the denture in the region corresponding to the ridges of the canine areas (*see* conventional impression techniques). However, care must be taken to ensure that no unplanned increase on OVD is inadvertently incorporated.

In the case of the maxillary impression, there

Fig. 16 Suggested form of lower 'rim' for denture form impression technique

Fig. 17 Completed functional impression of denture form — recorded in PVS putty

Fig. 18 Plaster of Paris dies or stents of impression of denture form. These enable an exact wax form to be poured

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- 5 Murray I D, Wolland A W. Simple denture copying using the Murray-Wolland duplicating box system. *Dent Tech* 1986; 39: 4-8.
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is also merit in perforating the palate in the mid-line of the rugae to prevent any possibility of imperfections in the impression, eg air bubbles.

Although this chapter has described impression techniques for a variety of clinical conditions, it has also stressed the importance of good communications with the laboratory. Good rapport between the dentist and technician will ensure quality of all stages in the prescription of dentures.

Conventional techniques, however, do little to inform the technician on the customising of upper record rims. In one system, the Swissedent system (*vide infra*), this is addressed and shall be discussed briefly in the next chapter because the principles involved are soundly based.

Fig. 19 Photograph of a poor reline impression. In addition to the faulty form of the palate (caused by folding of excess material) the undercut tuberosity areas were not relieved — presumably the impression material was attached to the patient's tissues.