Impression Taking - Revisited

Most of us are familiar with the frustrating and costly experience of trying to insert a crown or bridge that, despite fitting accurately on both the die and the second pour, does not seat completely, has open contacts or is high in the occlusion. It doesn’t need or be like this! Poor fit often results from distortion or other inaccuracies in the impression, some of which can be difficult to detect chairside. If the clinician is unaware of the critical areas to be checked or lacks the correct armamentarium such as magnification aids, then many defective impressions are forwarded to the laboratory with the misguided expectation that a satisfactory restoration will ensue.

Taking impressions is like much of dentistry – both an art and a science – with multiple interrelated steps and many possibilities for discrepancies to be introduced unwittingly. Indications of a good impression are listed in Table 1.

In this article we aim to look at the various steps involved in impression taking, exploring ways to minimise problems and inaccuracies.

Soft tissue control
A thorough periodontal lead-up should be performed prior to the preparation and impression stages. Use of dental floss, interdental woodsticks and interproximal brushes is essential to minimise bleeding and seepage of inter-crevicular fluids to ensure an accurate recording of the abutment and adjacent soft tissues and to create a stable gingival height once the restoration has been cemented. Delivery of 0.12% chlorhexidine gluconate (with its ability to reduce tissue inflammation) to patients for whom fixed prosthodontic procedures are planned is a major aid in producing more accurate impressions. The solution can be delivered during the two-week pre-operative period, for two weeks during the time provisional restorations are in place, and for two weeks post-operatively.

Retraction
Good impressions start with good retraction and yet this procedure is often rushed or even ignored and, as a result, the impression is compromised. There are two widely accepted approaches to gingival retraction.

Single cord technique
This technique is perhaps the most commonly used but is often inadequate. It is best used when preparing margins at or above tissue height. If gingival tissues are healthy and no bleeding occurs when the cord is packed, this method will usually suffice.

Double cord technique
This approach is best used when subgingival margins are present and/or when tissue health falls short of ideal. The double cord technique is not simply inserting two cords and the following sequence will yield the best results:

• Remove enough coronal tooth structure to gain easy access to the interproximal areas (see Figure 1).
• Try to avoid preparing areas close to the gingival tissues when this is appropriate (for example on the palatal aspects of upper incisors). Gently insert an extra thin cord, such as a #0, into the sulcus. It is vital to use specially designed minimal thickness retraction cord packer at all times. The use of bulky flat plastic instruments can cause irreversible damage to the periodontal attachment.
• The #0 cord will provide a slight tissue deflection, allowing more access but,
more importantly, it will serve as a depth gauge to help avoid cutting epithelial tissue, thus making moisture/blood management much easier during the impression process.

**Figure 2**: A monophase impression showing a lack of surface detail.

**Figure 3**: A double phase impression showing excellent detail.

**Figure 4**: A putty wash one-stage impression showing how the putty displaces the light body off the tooth and into the buccal and lingual sulci.

**Figure 5**: A two-stage technique showing good coverage of the prep in light body but also spread onto adjacent teeth.

**Figure 6**: Cut a small escape sluice into the putty (the putty knife from Coltène – shown in Figure 7 – is ideal for this procedure).

**Figure 7**: The putty knife (Coltène).

In order to combat these various ill effects and to create a clean surface for accurate reproduction, preparations should be gently scrubbed with a cavity cleanser such as chlorhexidine antibacterial slurry, a 2% glycolic acid or an EDTA-based cleaning gel. Such cleaners also eliminate set inhibition of PVS materials.

Expasyl (Kerr) is a fast and painless alternative to packing retraction cord, in some cases. This product comprises kaolin and is impregnated with the haemostatic agent, aluminium chloride. Expasyl opens the sulcus, physically displaces the gingival tissue and leaves the field dry, providing the retraction needed for impression taking or cementation. It should be placed directly into the sulcus, left for one or two minutes and then rinsed off. Unlike retraction cord, Expasyl requires little or no application of pressure, thereby greatly minimising the risk of rupturing the epithelial attachment.

**Impression materials**

These days, polyvinylsiloxane is by far the most popular impression material. It is easy to use, produces excellent results and exhibits essentially zero dimensional change during the setting reaction along with good tear strength, good wettability and no unpleasant taste. PVS impressions can also be easily disinfected or sterilized, unlike other materials. Most manufacturers supply heavy, medium and light body materials along with a very heavy body material (putty), which is usually used to convert a stock tray into a custom tray for use with the wash technique. Three impression techniques can be employed with the addition polymerising silicones:

1. The monophase or single mix
2. The double mix or double phase
3. The putty/wash

No significant difference in accuracy has been found between the three techniques. A monophase technique is one in which a medium body material is used.
in both the syringe and in a custom tray (Figure 2). The downside is that more surface defects are present (Millar BJ, Dunne SM, Robinson PB, 1998).

A double phase technique employs a light body material in the syringe and a medium or heavy body material in a custom tray, and is regarded by many as the ‘gold standard’ approach to impression taking (Figure 3).

The putty wash technique is often used for its convenience in that it avoids the use of custom trays. It can be used in one of the five ways described below.

**Putty and wash together (single-stage)** This is probably the favourite technique in general practice in Ireland. It has the advantage of speed, particularly when a fast-set putty is used with a light body wash, and cost is reduced by use of the less expensive putty material in a stock tray. One disadvantage with this technique is that the high viscosity putty tends to push the light body wash off the prepared tooth (Figure 4). The wash material then ends up in the lingual and buccal sulci, which results in critical areas, such as preparation margins, being recorded with putty that does not pick up fine detail. This can be a particular problem when the preparation margin is high on the tooth, such as for inlays, onlays and three-quarter crowns. Clinicians using this technique need to consider using a putty and light body with viscosities as closely matched as possible, for example a soft putty and a relatively higher viscosity wash. It also helps to ask your assistant to place a finger indentation in the area of the preparation(s) and then fill this indentation with light body material so that all the margins should then be recorded with light body.

**Putty then wash (two-stage)**

The disadvantages here include the additional time of having to wait for two materials to set, contamination of the putty with saliva (which may prevent light body adhering to it) and difficulty in re-seating the putty in the mouth. There will be distortion of the putty or tray as the wash material is compressed and a tendency to force the wash out of the impression. Some wash material may pass along the occlusal surfaces of adjacent teeth, resulting in an occlusal discrepancy on the model (Figure 5)

**Putty, then sluices cut, then wash (two-stage)**

The putty impression is recorded at the beginning of the appointment and then a buccal sluice is cut for each prepared tooth (Figures 6 and 7). An area around each prepared tooth is also cut out with the putty knife. This method offers an improvement to the standard two-stage putty wash technique as the sluices allow for excess material to escape into the buccal sulcus rather than spread along the occlusal surfaces of the adjacent teeth. Space is also created for the prepared tooth area to enable it to be recorded with sufficient wash material, allowing the reproduction of much greater detail. Furthermore, as a fresh putty surface is created the risk of wash material debonding is less. This represents a good technique for putty wash, although additional time is required for cutting and trimming the set putty.

**Putty with a spacer sheet, then wash (two-stage)**

The putty is first inserted into the mouth with a spacer sheet on the putty surface. This spacer prevents the putty taking a detailed impression of the teeth. It also prevents contamination of the putty by saliva while conveniently providing sluices in the putty. The putty is removed immediately and allowed to set outside the mouth. Any distortion of a plastic tray will now be eliminated. The polythene sheet is peeled away prior to recording the final impression when a light body material is placed on the teeth and in the putty trough (Figure 8). This technique is quick and reliable. More light body, at a higher cost, will be needed for this method but the teeth will be with high detail.

**Putty with wash in the injection moulded technique (two-stage)**

The authors’ preferred technique is to record a pre-operative putty impression in a fairly rigid stock tray (Millar BJ, 2001).
Clinical

Table 1: Indications of a good impression

1. Uniform homogeneous mix
2. Tray adhesive carefully applied
3. Rigid, sturdy impression tray
4. No voids or pulls on margins, axial walls or occlusal table
5. Detailed margins with no tears or rough surfaces
6. No showthrough of heavy body material
7. Strong bond between heavy body and light body materials
8. Strong bond between impression material and tray
9. No tooth contact with tray

that there are no significant undercuts, loose teeth or bridges. Something has to give if an impression is to be removed from such undercuts. If the tray is rigid, the impression material itself has to distort and recover from the distortion. If in doubt, a rigid plastic tray is safer, still eliminating distortion by the putty during insertion but offering flexibility during removal, if necessary. Impressions that become stuck in the mouth, or are difficult to remove, tend to be a combination of a rigid material (such as Impregum or a silicone putty) in a rigid tray (which could be metal, rigid plastic or custom), particularly where the tray is too close fitting.

2. Potential exists for tearing if there is not enough space between the equatorial line of the tooth and the side of the tray.
3. Double arch impression trays should be sufficiently sized to encompass the canine tooth, ensuring proper occlusal registration.
4. Double arch trays should be tried in the mouth at full closure to ensure proper relationships and adequate space between the retromolar pads and hamular notches.
5. Stock trays should fit the patient’s arch form closely, thus minimising wastage of the impression material and facilitating seating of the loaded impression tray.
6. Custom trays offer significant advantages in accuracy and potential savings (Christensen GJ, 1994)

Distortion resistance

As discussed above, all trays must be rigid enough to resist deformation. They should also be extended sufficiently to support the impression material throughout all relevant areas of the arch. Flexible plastic trays are certainly not advised for elastomeric impressions for prosthodontics. They may be considered for low viscosity materials such as alginate for study casts only. If a non-rigid plastic tray is used with putty, the tray will distort during insertion. On removal from the mouth the tray may partially rebound or remain distorted, which will compromise the dimension accuracy of the die.

which has been shown to be extremely accurate (Caputi S. Varvara G, 2008)

A temporary crown can be made using this putty impression. Some putty is then cut away around the prepared tooth to create a buccal sluice channel. A hole is drilled through the putty from the outside via a perforation in the plastic tray into the prepared tooth area. The tooth is dried, the putty inserted into the mouth and seated. You should then hold the tray down on the tooth, as the cool storage conditions act to lengthen the working time by between one and two minutes without adversely affecting its accuracy.

Addition silicones have excellent dimensional stability, with shrinkage over 24 hours of only 0.05%. Dies produced at seven days are, for all practical purposes, as accurate as those produced at 10 minutes.

One should be aware, however, that the degree of dimensional stability varies from manufacturer to manufacturer.

Impression tray selection

Selecting an appropriate tray is an extremely important (Carrotte PV, Johnson A, Winstanley RB, 1998), but often overlooked, part of successful impression taking. Full arch, perforated metal, rigid plastic (Figure 10) or custom trays (Figure 11) are recommended for fixed or removable prosthetic restorations involving three or more units. In cases involving only one or two simple restorations (single crowns, inlays and onlays), small double arch impression trays (Figure 12) offer the advantage of simultaneously capturing the preparations, opposing dentition/occlusion and occlusal registration.

A number of factors should be taken into account when selecting a tray.

Tray size

1. Ensure that the tray permits a minimum thickness of 5mm surrounding the preparation and

Early forms of the addition silicones were hydrophobic, however most currently available materials are hydrophilic as a result of the inclusion of surfactants within the material. Although addition silicones are hydrophilic, it does not mean that they can be used to take impressions of wet preparations. The field must always be free of moisture in order to produce an accurate impression. In addition, care must always be taken in warm environments as this accelerates the setting reaction. In this situation the impression material can be stored in a refrigerator and then used immediately after removal, as the cool storage conditions act to lengthen the working time by between one and two minutes without adversely affecting its accuracy.

Whichever of the above techniques is used, one useful tip is to inject a little wash material over the tooth then air disperse the wash material using a gentle stream of dry air from the 3-in-1 tip. This pushes material over the tooth then air disperses material into crevices and corners, and into the gingival sulcus, as well as creating a thin layer over the prepared surfaces, as accurate as those produced at 10 minutes.

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1. Ensure that the tray permits a minimum thickness of 5mm surrounding the preparation and
2. The selected tray should not be distorted by the weight of dental stone nor should there be ‘bending’ of unsupported areas.

3. Excessive pressure on the tray should be avoided during the final setting of the impression material. Doing so might squeeze the material towards the tray wall, which can, as described above, spring back after the pressure is removed.

4. Remember that there is no heavy body material or putty exists with the strength to overcome flexural errors caused by deformation of the impression tray.

Custom (special) trays
Most authors refer to the advantages of a rigid special tray to provide a uniform, specified thickness of impression material offering reduced distortion, improved dimensional accuracy and fit of estoration. However, not all research studies are in agreement on this.

Dual Arch impression techniques (DUAT)
For a dual arch impression to be successful a number of factors must be considered, notably:
• The impression tray must be rigid; metal trays are preferable
• The tray must prevent distortion and have no elastic memory rebound. Plastic trays are often highly elastic and will deform under the hydraulic loading pressure of most heavy-bodied PVS impression materials. Their high side walls and thick retromolar pad areas often create interference with hard and soft tissues, resulting in expansion flex. You can check this by observing interdigitation of the contralateral side. If the patient is able to bite together without shifting his or her mandible and the contralateral teeth are in the correct position then the tray is a good fit.

Just as critical, however, is the rigidity of the impression material. For the dual arch technique to succeed, the impression material selected must exhibit the following:
• A high rigidity when set so that it becomes an integral part of the system
• Enough fluid viscosity so that it moves the light body beyond the preparation margins but at the same time does not displace the light-bodied material away from the preparation.

Many PVS heavy-bodied materials have too little flow, resulting in displacement of the light body and the introduction of compression flex in the tray.

Various studies have shown that crowns manufactured from dual arch impressions (Figure 1.3) are equivalent in marginal accuracy and superior occlusally to crowns fabricated from complete arch impressions, especially when used to record preparations on single premolar (Davis RD, Schwartz RS, 1991; Davis R, Schwartz R, Hilton T, 1992).

Poor results tend to be found when the technique is used on both maxillary and mandibular second molars and bridge cases. One particular advantage of the dual arch technique is its ability to reduce retching.

Contamination from latex gloves
Compounds such as sulphur used in the vulcanisation of latex surgical gloves may interfere with the polymerisation of PVS impression materials and so any contact should be avoided.
For example, if mixing putty by hand, sulphur residue from the gloves can contaminate the platinum catalyst and displace the light-bodied material away from the preparation.

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Conclusion
The day may soon come when conventional impression taking is a thing of the past, superseded by sophisticated scanning techniques. However, for the foreseeable future impressions are here to stay and it is important to develop a technique with which the clinician is confident and competent, and can be performed reliably and predictably.

References
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