

# THE ESSENTIAL ELEMENTS OF IMPRESSION TRAY DESIGN

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Impression trays are used every day in most dental practices. But is enough attention given to them, especially in respect of their specific use by both clinicians and dental technicians? In some instances, it would appear that not enough consideration is given to their correct selection and use.

It could be that impression trays are sometimes regarded as being a low-cost consumable, and are perhaps regarded simply as a carrier or conveyance for an impression material, rather than an important component in the treatment programme.

The objective of this short article is to examine the essential elements that apply to the design, use and application of dental impression trays, and to shine some new light on the aspects of tray design and selection that can be instrumental in achieving more accurate and thus more successful impressions.

## Tray types and impression materials

Clinicians seem to pay much more attention to the selection of ideal impression materials, and this is reflected in the dental industry's promotion of them. Exceptional impression materials are now available, but the evolution of a more effective and functional impression tray system has not followed at the same pace. The only really significant 'advance' (if one could call it that) in the past 45 to 50 years has been the plastic 'disposable' impression tray.

While this has clearly proved convenient and useful for the busy dental practitioner, as well as being relatively cost effective, the plastic disposable tray does have shortcomings. The main disadvantages are in the material of their manufacture and in the general design of most of the trays currently available. It is also important to recognise that over time disposable plastic trays will become even more commonplace, due to the increasingly rigorous standards for correct infection control.

The good news is that of late there has been a significant change in the design and production of dental impression trays, and consequently they have started to achieve greater recognition as an important component in the dental treatment programme.

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## Problems in impression taking

Some of the problems that can result through incorrect impression tray selection can be seen in the following ways:

1. The resultant restoration or prostheses can prove to be illfitting, and thus not perform its main function in the mouth
2. There is then the possibility of a consequent remaking of the restoration. This situation and its associated costs can prove inconvenient to the patient, clinician and technician, and does not engender goodwill
3. Technicians may not be able to make use of the resultant models to fabricate a correctly shaped/contoured prosthesis, and may be forced to compromise their work. This is quite common in the fabrication of full dentures
4. In implant and other complex crown, bridge and precision attachment cases there can be no compromise, as the highest degree of accuracy and subsequently a perfect fit is the only acceptable outcome.

It can therefore be seen that the utmost care and attention must be paid to the production of acceptable impressions that can then be successfully utilised in the fabrication of a laboratory-produced restoration.

So what are some of the most common failings in the taking of impressions? They can probably be summarised as follows:

1. Insufficient area of the mouth captured by the impression
2. Inadequate detail within the impression. This can be a deficiency of the all-important margins around a preparation. It may also be that the impression has not captured all the standing teeth (e.g. a third molar). This could be critical, especially when accurate occlusal registrations are required
3. Failure to reproduce soft tissue details, e.g. poorly formed alveolar ridges and muscle attachments, such as the labial and lingual fraenum. All of these areas are especially important in the correct shaping of dentureflanges
4. Distortion of the impression. This is not always apparent to the naked eye, but can be the result of distortion of the impression tray and more likely to occur with the perforated and thin-walled plastic disposable trays.

Most, if not all, of the above problems can be attributed, if not totally, then certainly in part, to the wrong choice of impression tray.

Common errors in the choice of a correct tray can be as

simple as the tray being too big or too small. The clinician should also consider whether a metal tray would be more suitable than a plastic tray, or perhaps if a special tray is the best answer. This might well be the only solution to those cases that cannot be adequately catered for by a manufacturer's stock tray.

The decision will invariably rest with the practitioner, but the wrong choice of tray can also be compounded when the wrong impression material is used, or when the manufacturer's instructions are not strictly adhered to. Thus it is in the patient's best interests for the dentist and dental technician to communicate about choosing the right impression tray to meet the specific needs of each clinical case.

### Impression tray design

Metal trays are available in dentate and edentulous types, perforated and non-perforated, and they do have the advantage of being strong, thus highly resistant to distortion. However, they can be difficult to clean, they can also deteriorate after autoclaving, and are initially expensive to buy. Autoclaving also takes time, and while trays are in the laboratory there is the chance that they may be lost or subject to a delay before being returned. Also, some metal trays do not possess the ideal features that are required of them, and in many instances they need to be modified. This is usually through the addition of extra extensions to the tray sides or by adding a post dam in wax, impression compound or a hard silicone. Metal 'rim-lock' trays have proved to be reasonably satisfactory in use, but their design (now 70 years old) does not provide an adequate anatomical shape and in upper trays it is often found that an excessively thick layer of impression material is present in the palate, this being due to the very flat palatal profile. Similarly in lower rim-lock trays, they do not always capture the full detail or depth of the sulcus and retromolar pad areas.

There have been numerous papers published on the topic of tray selection, many of which favour a metal tray or a rigid plastic tray. In their Guidelines for Crown and Bridge, the British Society for Restorative Dentistry states that: 'Impression trays whether custom made or of stock variety should:

- Have sufficient extension to support an impression of all structures to be recorded
- Be rigid in use
- Incorporate occlusal stops and, where indicated, features appropriate to aid the retention of impression material
- Have a robust handle
- Be capable of withstanding autoclavable sterilisation, if not designed for single use.'

However, recent advances in technology have enabled the designers and manufacturers of dental impression trays to produce plastic/resin trays that do possess the ideal features that can match, and even exceed, those of the metal trays.

### Conclusion

As impression materials continue to improve, they surely require to be used with suitably compatible dental impression trays. The Schreinemaker concepts together with the Clan Borderlock technology now make it possible for practitioners to combine the very real advantages that modern impression materials can offer with correctly designed impression trays to ensure the production of highly accurate dental impressions. In addition, concerns about infection control issues make it highly likely that the disposable tray will become even more widely used.

It is therefore apparent that the use of only the most suitable, practical and cost-effective products will satisfy today's exacting standards, and that practitioners should not be content to compromise the treatment options that they can offer in conjunction with the dental technician.

### References

- Carotte, PV, Johnson A, Winstanley RB (1998) The influence of the impression tray in crown and bridgework – an investigation and review. *BDJ* 185(11): 580-585
- Guidelines for Crown and Bridge (1998) British Society for Restorative Dentistry

#### The Schreinemaker's concept

In the early 1960s a Dutch clinician, Dr Schreinemaker, designed and produced what can be described as truly anatomical impression trays. The Schreinemaker name became internationally known, and the trays incorporated many features that could not be found in other dental tray types. These features included:

- Cast metal construction, for strength, durability and an inability to distort
- A highly polished finish that resists abrasion and enables easier cleaning
- A contoured vestibular border that pushes impression materials into the full depth of the muco-buccal fold
- An anatomically-shaped tray border that allows for avoidance of the pronounced connective muscles and variable tray shapes to suit the different intra-oral arches (i.e. normal, square and gothic)
- Retentive slots in the trays also assist in impression material retention
- A specially developed 'paint-on' impression adhesive, providing even more security and control
- A maxillary post dam that is effective in the prevention of gagging.

The trays also allowed for an increased dynamic pressure to be applied, resulting in exceptional reproduction of surface detail. The above-mentioned features also contributed to a reduction of approximately 30% in the use of impression material, therefore offering a cost saving.

Dr Schreinemaker also created a simple measuring system that enables the clinician to determine accurately the most suitable tray for the patient, thus reducing even further any element of incorrect tray selection.