Masterclass in Clinical Practice

Dental Implants

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Part 3: Accurate transfer of the soft tissue emergence profile for fabrication of the definitive implant-supported restoration

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Introduction

Part 2 of this Masterclass focused on the use of fixed, provisional restorations to develop the emergence profile of the peri-implant gingiva.

After the maturation and stabilization of the peri-implant gingiva, the soft tissue contours must be accurately preserved and transferred to the dental laboratory for the definitive restoration. All the clinical time spent shaping this emergence profile would be in vain should the exact morphology thereof not be accurately replicated in the definitive impression.

This final section aims to provide clinical tips and steps to predictably record the developed emergence profile, and to transfer sufficient information to the dental technician to facilitate fabrication of a definitive restoration which will support the peri-implant gingiva. A short video is provided to show the conventional impression technique using a customised impression post.

Anatomy of gingival fibres

It is well worth it to revisit the anatomy of the periodontium and especially the gingival anatomy in the supra crestal zone. The gingiva is attached to the tooth via Sharpey's fibres that insert into the cementum of the root. The gingiva above the cemento-enamel junction is attached to the tooth via hemidesmosomes. The gingival fibres ensure stability of this tissue and even if the fibres are damaged by impression taking, it will heal and restore the attachment.

In comparison the peri-implant gingiva does not insert into the titanium and the fibres are arranged parallel to the titanium abutment and attached via hemidesmosomes only. This implies that when the implant abutment is removed from the mouth, the supra crestal gingiva has no support whatsoever and will almost instantly start sagging inwards, losing its shape. Should an impression be taken with a stock impression post, the impression material may then push this unsupported peri-implant gingiva outwards due to the pressure from the impression material being "injected" with force into the void around the impression post. The lab has no way of verifying the true shape of gingiva or the emergence profile of your provisional crown under these conditions. This will of course defeat the whole objective of using a provisional restoration to ensure the best aesthetic outcome as you will not be capturing this emergence profile accurately.

What is the rate of the soft tissue collapse after removing the provisional crown?

Recent studies on the rate of collapse give an idea of how fast this collapse takes place. Digital scan/impressions done in some of the studies were done within 10s of removing the provisional crown and still could not record the gingival anatomy accurately.[1] The technique described in this article of scanning the provisional crown, will of course be as effective as the customised healing abutment for the analogue impression as shown in the video.

The rate and extent of collapse varied according to what level of the supra-crestal gingiva was assessed. Although it is still unclear what effect these soft tissue changes may have on the definitive restoration or aesthetic outcome, the fact remains that changes start happening almost immediately, making the accurate capture of the emergence profile almost impossible with conventional analogue and digital impression taking techniques.[1, 2]

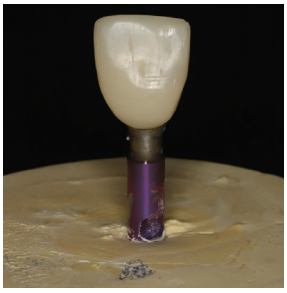

Figure 1: Provisional restoration attached to appropriate implant analog rigidly mounted into dental plaster.

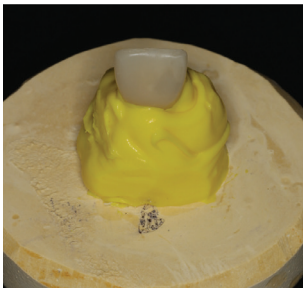

Figure 2: Mold impression material around the implant analog and the provisional restoration. Ensure that this material extends over the marking of the gingival margin.

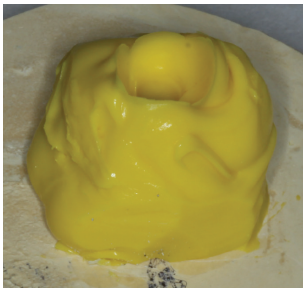

Figure 3: Once buccal marking has been made, loosen the prosthetic screw, and remove the restoration from the implant analog.

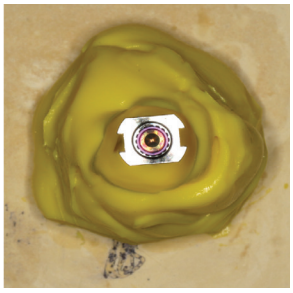

Figure 4: Impression coping attached onto the implant analog revealing a space around the impression post representing the emergence profile.

One can expect that as soon as we disconnect the healing abutment, or the fixed provisional restoration from the implant, the gingival architecture and morphology of the emergence profile will change nearly immediately. Nissan et al. (2015) stated that time is an important factor because the peri-implant gingiva has been shown to change within the first 40 seconds after removal of the healing abutment.[3] Duran et al. (2018) found the changes were more than 1.3 mm in the middle of the supra-crestal soft tissue and 0.5 mm at the coronal level.[4]

When one records the impression for the definitive fixed, implant-supported restoration, the dental technician requires an exact impression of not only the interproximal surfaces of the adjacent teeth and surrounding soft tissues, but also the exact morphology of the emergence profile. Due to the rapid soft tissue changes, it is almost impossible to record the exact emergence profile in the conventional manner as one would with a natural tooth where the gingiva is attached and stabilized by inserting gingival fibres. The result then would be either an over- or under-contoured definitive restoration.

The definitive impression can be made either using analogue or digital methods and needs to be adapted to allow for the differences between the implant and natural tooth restoration.

Customised impression coping for use with analogue impression taking.

When using the analogue method, the impression coping (either open-tray or closed-tray) is attached to the implant and "picked up" within the impression material and impression tray. Unfortunately, the emergence profile of the impression coping, like standard healing abutments, is insufficient to support the soft tissue of the emergence profile developed with an anatomical correct provisional restoration.

Most clinicians rely on the injection of a light-bodied impression material around the impression coping to fill the space between the impression coping and the mucosa. Unfortunately, by the time this material is ready to be injected around the impression coping, there has already been significant collapse of the soft tissue emergence profile. In addition, the light-bodied impression material may displace the gingiva outwards due to "hydraulic" pressure during impression taking, which will further distort the emergence of the provisional restoration/healing abutment. Most of the VPS (vinyl polysiloxane) impression materials are also hydrophobic in nature, which means that they are further displaced from the moist subgingival soft tissues. Together this results in the final impression not being an accurate recording of the developed emergence profile.

To overcome this, the clinician should consider making a customised impression coping.

List of materials/equipment needed to fabricate a customised analogue impression coping (see video for clinical process):

1. Impression coping (open- or closed-tray).
2. Implant analog with the apex mounted in a rigid material like dental plaster.
3. Appropriate prosthodontic implant tools (implant driver and torque wrench).
4. Impression material, for example laboratory putty, light bodied VPS impression material etc.
5. Flowable composite resin.
6. Dual-curing temporary resin material.
7. Curing light.
8. Marker (pen, pencil etc.).

Steps to follow:

1. Ensure that you have an implant analog with its apex mounted into a rigid material. It is a good idea to have one for each of the different implants used most often in your practice.
2. Trace the gingival margin using a pencil on the fixed provisional restoration. This is described and shown in a previous Masterclass in Implantology.[5] Remove the provisional restoration from the implant and position an appropriate healing abutment on the implant to prevent complete collapse of the peri-implant soft tissue which may cause unnecessary discomfort when impression post is connected.

Figure 5: Flowable composite resin can be used and should be light-cured in increments.

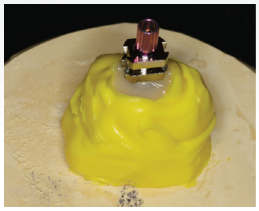

Figure 6: The space of the emergence profile filled with flowable composite resin.

3. Clean the provisional restoration to remove any plaque/debris and attach the restoration onto the implant analog. Use the appropriate driver and torque wrench to ensure correct positioning and proper seating (Figure 1).
4. Inject or mold the impression material around the implant analog and the emergence profile of the restoration. Try to minimize air bubbles and voids. Use a flat plastic or similar instrument to contour the impression material accurately to the gingival pencil mark. Allow the material to set sufficiently (Figure 2).
5. Once set, mark the buccal aspect of the restoration on the impression material/plaster.
6. Loosen the prosthetic screw and remove the provisional restoration from the implant analog (Figure 3).
7. Position and attach the impression coping onto the implant analog. There will be a clear space surrounding the impression coping (Figure 4). This space should then be filled with flowable composite and light-cured in increments (Figure 5 and 6). If a large and deep space is to be filled, a dual-curing temporary resin material can be used. Ideally the flowable composite should extend to slightly above the gingival margin which you have marked for this purpose before removing the provisional restoration from the mouth.
8. Once cured, mark the impression coping to indicate the buccal orientation of the impression coping using a permanent marker.
9. The customised impression coping is then disconnected from the implant analog and any sharp edges smoothened using any composite polishing bur.
   The healing abutment should be disconnected from the implant in the oral cavity and the customised impression coping inserted and tightened onto the implant (Figure 7). The patient may experience slight discomfort during this process especially if the peri-implant soft has collapsed a lot. Tighten the customised impression post slowly to minimize the discomfort, pausing periodically if needed. The accurate seating of the impression coping should be confirmed radiographically.

Figure 7: The polished customised impression coping is seated intra-orally.

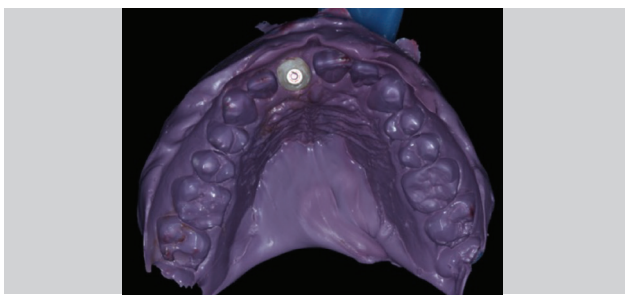

Figure 8: Analogue impression with the customised impression coping using polyether impression material (Impregum®)

10. The steps detailed in Part 2 of this Masterclass should then be followed to obtain the impression in the customised impression tray. Once the impression material has set and the impression is removed from the oral cavity, you can expect to see an impression like that in Figure 8 (see also video).

Accurate transfer of emergence profile information using available digital technologies:

Computer-aided design and computer-aided manufacturing (CAD-CAM) have also been used to accurately transfer

Figure 9: Full arch intra-oral scan with provisional restoration removed.

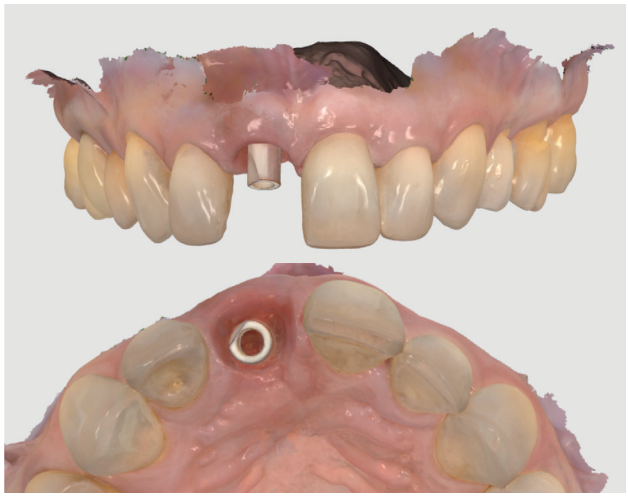

Figure 10: Intra-oral scan with the scan flag in position.

the emergence profile from the provisional to the definitive restoration.[2, 6]

Performing simple intraoral tissue scans for implant restorations can mostly be performed with adequate precision. However, reflective tissue that undergoes rapid alterations almost immediately after the removal of the provisional restorations can complicate the accurate recording, especially for multiple implants.[7]

Liu et al. (2017) described a digital impression technique that "records peri-implant soft tissue contours and the emergence profile as well as the 3D implant position within a single digital impression, avoiding the collapse of the gingival architecture while recording the impression".[6]

It is crucial to keep in mind that peri-implant soft tissues are supported by the provisional restorations, without which the gingival architecture will collapse as the gingival tissues do not have fibres inserted into the implant abutment as with natural teeth. Fortunately, the inner soft tissue contours and

Figure 11: Digital scan of the entire provisional restoration attached to an implant analog.

the emergence profile of provisional restorations tend to complement each other, resulting in the scanned images of subgingival prostheses that are usually not distorted.[6]

List of materials/equipment needed to perform a digital impression and recording of the created emergence profile:

1. Digital intra-oral scanner
2. Appropriate scan body or scan flag
3. Appropriate implant analog
4. Appropriate prosthodontic implant tools (implant driver and torque wrench)

Steps to follow:

The steps detailed in Part 2 of this Masterclass should be followed to record a digital impression of the implant positioning using a digital scan body, or scan flag. In broad, these steps include a full arch scan with the healing abutment or provisional restoration removed (Figure 9), a sectional scan with the scan body or scan flag in position (Figure 10), a full arch scan of the opposing arch and a buccal jaw registration scan.

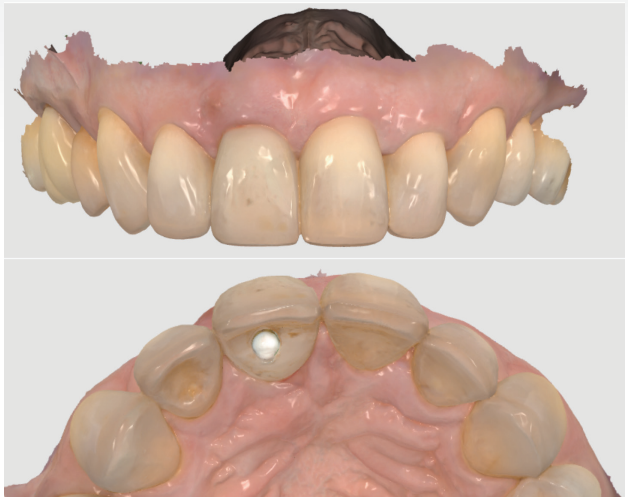

Figure 12: Intra-oral scan of the provisional restoration attached to the implant intra-orally.

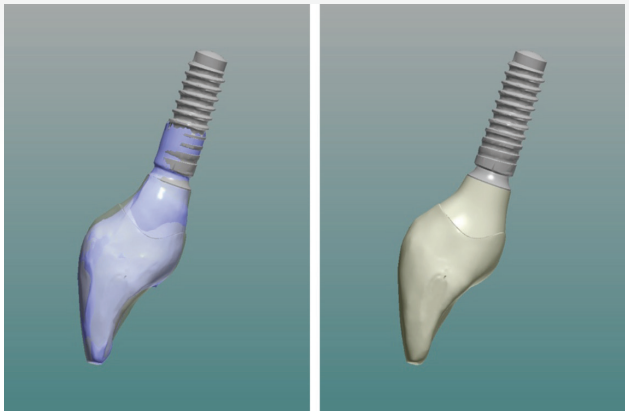

Figure 13: In the dental laboratory the morphology of the provisional restoration (blue) can be transferred to the design of the definitive restoration (right)

In addition to these steps, the clinician should also perform the following:

1. Open a "new case" on the scanner program.
2. Attach the provisional restoration or modified healing abutment onto the implant analog and tighten the prosthetic screw according to manufacturer's instructions.
3. Hold the apex region of the implant analog with an artery forceps, or similar instrument. Scan the provisional restoration, including both the supra-gingival and the subgingival regions, extra-orally with an intraoral scanner (Figure 11). The emergence profile of which would accurately represent the subgingival soft tissue contours.
4. Disconnect the restoration/healing abutment from the implant analog and reposition it intra-orally on the implant.
5. Record another full-arch digital scan of this restoration in position (Figure 12).
6. Send all the above digital impressions to the laboratory.

The dental technician will then process the scans and transfer the emergence profile of the provisional prosthesis to the digital design of the definitive prosthesis. The definitive crown should be designed with the same emergence profile as that of the provisional crown.

Figure 13 shows the design done in the laboratory where the emergence of the provisional restoration is used to guide the emergence of the definitive restoration.

Conclusion

Once the ideal gingival zenith and emergence profile of the peri-implant soft tissue has been established, the clinician needs to accurately transfer this morphology to the dental laboratory to aid the correct emergence profile design of the definitive restoration. The inevitable collapse of the peri-implant soft tissue following healing abutment or provisional restoration removal is significant and needs to be accounted for. The clinician can predictably and accurately transfer the created emergence profile with an analogue impression by customizing the impression coping extra-orally using flowable composite resin as shown in the video. Digitally the clinician may opt to send an additional digital scan to the dental laboratory which includes a digital scan of the provisional restoration both extra- and intra-orally.

The dental technician should be able to design the emergence profile of the definitive restoration to be identical to that of the provisional restoration (see Figures 14-16).

If this emergence profile is replicated accurately, the resultant definitive restoration should predictably support the peri-implant soft tissues, maintaining a healthy soft tissue collar and stable aesthetics in the long term. All of what has been described and shown in this 3-part Masterclass, is valid only if the implant is placed in the correct 3D position, with an appropriate diameter implant allowing for sufficient hard and soft tissue surrounding the implant to support the soft tissue, providing a long-term sustainable result.

Figure 14: Emergence of provisional restoration as viewed from labial (left) and palatal (right).

Figure 15: Emergence of definitive restoration as viewed from labial (left) and palatal (right).

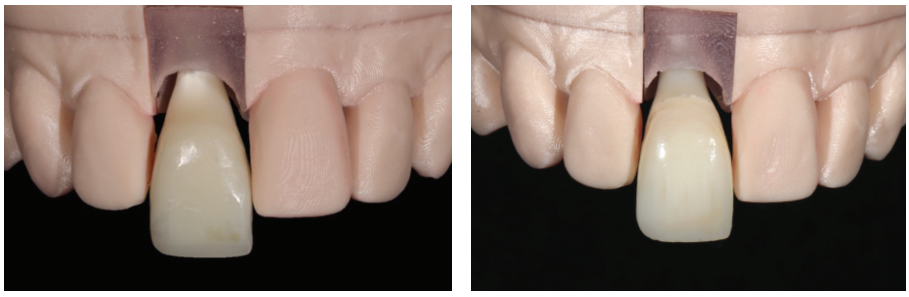

Figure 16: On the printed model the accurate duplication of the emergence profile of the restoration can be seen when comparing the provisional restoration (left) with the definitive restoration (right).

Scan QR Code to view video

References

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