The mock-up: your everyday tool

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For a wax-up, also known as a diagnostic wax model, laboratory wax is used to create an aesthetic concept based on a patient's plaster model. However, the aesthetic and functional use is limited. From an aesthetic perspective, even though the wax does not reproduce the tooth shade perfectly, it facilitates visualisation of the shape and position of the teeth in the concept.

As far as function is concerned, even when a high-performance articulator is used, it is still difficult to replicate the full range of masticatory movements.

The mock-up, essentially a 'preview' produced from composite, is a technique all too rarely employed by dentists, but which proves exceptionally practical in a wide variety of situations in routine clinical practice. It offers a preview of the intended aesthetic result and as such plays a decisive role in treatment planning (Marus, 2006; Vargus, 2006; Pena et al, 2009).

The mock-up phase follows validation of the wax-up. In this phase, the concept model is adapted directly in the mouth following validation on the plaster model (Magne and Belser, 2004; Magne and Magne, 2006). This facilitates transfer of the wax-up data from the patient model directly into the mouth (Hollar, 2008; Peyton and Arnold, 2008).

The trial fitting in the mouth offers the opportunity of verifying the concept from an aesthetic, functional, and psychological perspective. This last aspect is of particular significance, considering that it imparts an important principle into patient acceptance, namely being able to first try out a solution and then make an educated final decision. In this way, the patient plays an active role in the decision-making process, which considerably improves communication (Willhite, 2006).

It is important to note that communication with the dental technician is also optimised in the process, which promotes smooth cooperation between the practice and the laboratory. It is only possible to implement minimal corrections directly on a wax-up, whereas the dentist is free to make aesthetic changes to the mock-up by adding or removing materials generally available in the dental practice (Simon and Magne, 2008).

In addition, the mock-up can also be used to check the occlusion in the mouth in order to validate the accuracy of the wax-up. Following any corrections, a duplicate of the mock-up is sent to the laboratory. The dental technician now has additional information at their disposal, with which they can achieve a predictable aesthetic result.

Figure 1: Cartridge with self-curing composite (Structur 3, Voco).

Figure 2: Preoperative situation, smile.

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Figure 3: Preoperative situation, intraoral in occlusion.

Figure 4: Preoperative situation, intraoral in non-occlusion.

Treatment plan

Mock-ups are suitable for treatment in the anterior region requiring corrections to the shape of teeth through the addition of material, and to a lower extent also adaptation of the position of the teeth. The main indications are thus loss of substance on vital teeth, missing individual teeth, diastema or other congenital aesthetic defects, which permit a bioaesthetic approach (Dietschi, 2011).

Once a diagnosis has been established and the type of treatment selected, the dentist orders a wax-up based on the patient's tooth model. Of course, they also need to inform the dental technician in the laboratory of what they expect in terms of shape and position, but not yet the shade.

The first step is for the dentist to validate the wax-up on the model; this allows them to make any necessary corrections directly in the practice using suitable materials. In such cases it is always worth asking the dental technician to send additional wax with which any corrections requiring addition of material can be performed.

The wax-up is then shown to the briefed patient (it is a 3D simulation of the concept design), making sure to mention the reservations (the tooth shade cannot be replicated in a wax-up) and compared with the plaster model without wax-up in order to demonstrate the improvements objectively.

Once the patient has accepted the wax-up and any necessary corrections have been made, the wax model is transferred from the plaster model into the patient's mouth in order to simulate the treatment intraorally. These steps are described in the 'step by step' section.

The mock-up is shown to the patient in order to determine the optimal tooth length and the general proportions of the new smile. It is still possible to make corrections at this stage. Following any corrections, the dentist and patient approve the mock-up and an impression is taken, which is then sent to the laboratory, where it serves as a reference for the final production of the concept.

Materials

Mock-ups are easy to produce in routine clinical practice as long as there is sufficient material available and the user masters the necessary skills in advance. In this article, we describe a technique in which self-curing composite (Structur 3, Voco) (Figure 1), which is usually employed in the production of temporary crowns, bridges and inlays/onlays, is deployed in the scope of an off-label use.

In contrast to laboratory wax, which is used for wax-ups, the visual properties of this material allow reproduction of the natural tooth shade (within a sufficiently large range from A1 to A3.5 including the shades B, C and Bleach Light).

The mechanical resistance of the material makes it possible to simulate the occlusion of the mock-up in the mouth.

Self-curing composites are similar to conventional light-curing composites. As a result, the composite can be adhered to the mock-up in order to compensate for defects or change the shape (tooth elongation, curvature of vestibular tooth surface, incisal cut-back, etc). The retention occurs mechanically, ie, no cement is required. In contrast to a temporary crown, the mock-up is ultimately destroyed upon removal.

Step by step

The clinical case presented here to illustrate the workflow was a consultation for aesthetic reasons. The patient wanted to improve his smile considerably without resorting to invasive techniques (we restrict ourselves here to the implementation of a mock-up in the maxilla). The first step involves taking a number of photos in order to analyse the initial clinical situation with the patient (Hinet et al, 2011) (Figures 2-4).

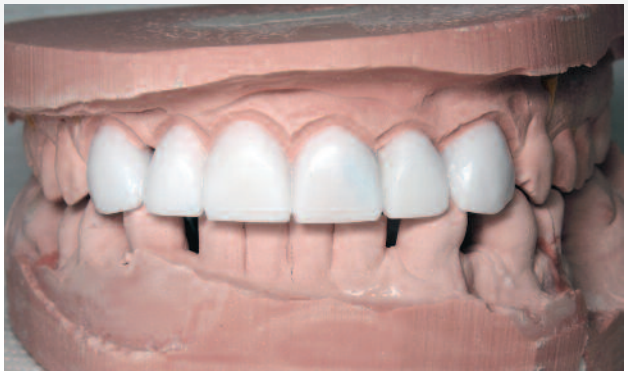

Figure 5: Wax-up without preparation of the teeth.

Figure 6: Silicone wax-up impression.

Figure 7: Verification of the accuracy of the wax-up impression.

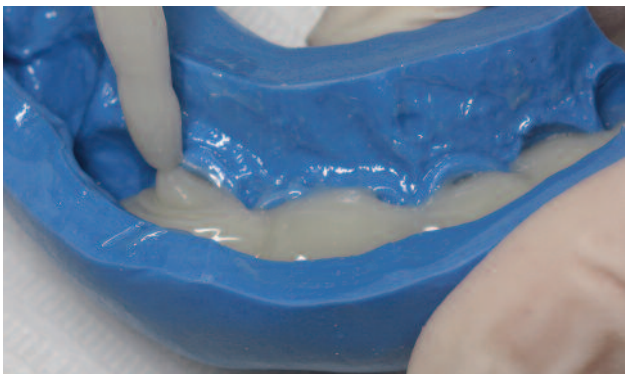

Figure 8: Filling of the impression with self-curing composite (Structur 3, Voco).

A plaster model serves as the basis for production of the wax-up (Figure 5). An impression is taken of the wax-up (Figures 6 and 7), which is used in the mouth as a guide for the implementation of the mock-up.

The guide is tried in the mouth and any necessary corrections made with a scalpel. The shade of the self-curing composite (Structur 3, shade A1, Voco) is now selected in accordance with the patient's expectations and the tooth shade of the natural teeth.

The impression is filled with the composite (Figure 8) and inserted in the mouth (Figure 9). The impression is removed at the earliest 1.5 minutes after mixing is started (Figure 10). However, final processing can only be performed after four minutes.

The shape is adjusted either by means of contouring in conjunction with water cooling as in the case of conventional composites, or by filling defects with a flowable composite (Grandio Flow, Voco) (Figures 11-13). Finally, the structure and dynamics of the occlusion are verified.

As soon as all adaptations have been completed, the mock-up is presented to the patient for his aesthetic approval: shape, position and tooth shade. If necessary, further adaptations can be effected in the same way, ie, via contouring or filling with composite.

The data are sent to the laboratory as photos (portrait, smile and intraoral) (Figure 14) along with an impression of the mock-up and the analysis of the smile. The dental technician in the laboratory then has the necessary and sufficient aspects at their disposal to produce the actual prosthetic restoration in accordance with the patient's and dentist's wishes (Reshad et al, 2008).

At the end of the treatment session, the question remains as to what to do with the mock-up. The dentist has the choice between two possibilities. One option involves removing the mock-up and permitting the patient to leave the practice with the restored initial clinical situation. No invasive or irreversible interventions were performed and the patient is happy to have 'tried out' his future smile without having to sacrifice any tissue or be anaesthetised.

The other option is to allow the patient to leave with the

Figure 9: Insertion of the impression with self-curing composite.

Figure 10: Occlusal view of the mock-up following removal of the impression and all excess material.

Figure 11: Filling of a bubble in the mock-up with flowable composite (Grandio Flow, Voco).

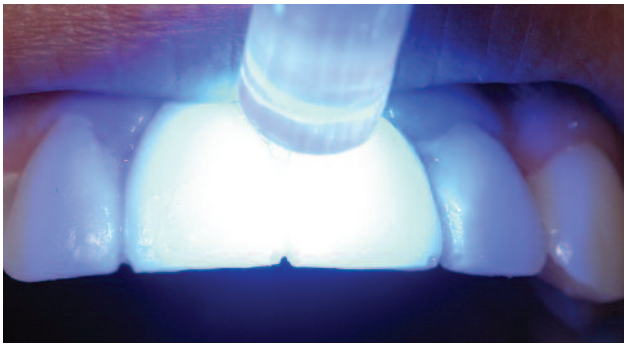

Figure 12: Curing of the flowable composite.

mock-up still inserted. This allows him to show off his new smile to his nearest and dearest and to verify its acceptance in social situations. Furthermore, this also enables the patient to test the articulation and masticatory loads in daily life.

At this point, it must be reiterated that the material is suitable for situations of this type as it was developed for the production of temporary crowns (Magne and Belser, 2004). It is down to the dentist to decide how long the mock-up can remain in the patient's mouth, whilst it goes without saying that special attention must be paid to exceptional oral hygiene. From the perspective of the psychological period for visual acclimatisation and functional aspects, one week appears to be a practical time (Magne and Belser, 2004; Magne and Magne, 2006).

Discussion

The mock-up technique offers a whole range of advantages. The quick, cost-effective method allows the patient to assess the desired result in his own mouth (Bloom, 2007). Until now, patients went along with dentists' decisions without being actively involved in the treatment plan, which occasionally resulted in unexpected results and possible conflicts.

A waiting period with temporary restorations makes it possible to assess the required result, but is not indicated in clinical cases with conservative or non-invasive approaches. In future, the patient will be able to 'try out' their new smile in order to get used to it quickly, and even go home wearing it to test it extensively from an aesthetic, functional and psychological perspective. Patient compliance increases as they can follow the treatment plan more calmly and is better informed.

In addition to improved patient communication, communication with the dental technician is also facilitated. Thanks to the impression and photographs of the mock-up in the mouth, the dental laboratory has a wealth of invaluable information at its disposal which was not systemically provided in the past (Reshad et al, 2008).

The dental technician is then not only able to test the wax-up from a functional perspective (structural and dynamic occlusion, position of the free margin for the articulation, lip support), but also from an aesthetic perspective (tooth shade, shape and volume of the teeth, smile symmetry, smile alignment with regard to facial aesthetics). The user-friendliness of the material means this technique is suitable for use in routine clinical practice.

Figure 13: Surface of the mock-up at tooth UL1 following filling of the defect.

Figure 14: Postoperative situation, occlusion check.

For the dentist, this technique is just as easy to perform as the production of temporary crowns. There is also no need for a rubber dam as the mock-up is produced under the same conditions as for a temporary crown. In addition, this non-invasive technique requires neither preparation nor retention, nor bonding, nor anaesthesia.

The patient will certainly appreciate this tissue-preserving approach. As such, the patient will perceive the treatment as more of an adventure (Hollar, 2008). Of course, however, mock-ups as a speciality are not without their restrictions.

The indication is restricted to prosthetic restorations in the anterior region, with severe malformations representing a contraindication, as the teeth may be positioned outside of the shape of the wax-up; the technique is also not indicated in cases where ameloplasty is required (too long or too heavily curved tooth).

As production of a mock-up requires a certain degree of dexterity; it should be initially practised on a plaster model before work is performed directly in the patient's mouth. The therapeutic treatment of a patient may require a longer period of time; even though the mock-up phase can be very informative and useful for patient communication, it remains an additional, facultative phase.

Dentists who do not use self-curing composites for temporary restorations could also view procurement of these materials as an additional cost factor. However, it is worth weighing up the fact that the mock-up could considerably improve patient compliance in an extensive treatment and thus the investment could indeed be worth it.

Nothing is more frustrating for a dentist than investing time and effort in the development of a long, complex treatment plan only for it to be rejected by the patient because it fails to meet his or her expectations.

Final remarks

Mock-ups constitute a simple, reversible technique that can be easily performed in routine clinical practice. As a preview made of composite, it allows validation of the planned prosthetic restoration in the mouth from an aesthetic, functional and psychological perspective.

This opens up a whole new dimension to the patient, as they are able to 'try out' their future smile, and is thus better able to imagine what the end result will be like. Patient compliance increases and the dentist-patient relationship benefits.

From the dental laboratory's perspective, this method provides the dental technician with additional information, which allows them to tailor their work precisely to the patient's and dentist's expectations. The improved communication reinforces the cooperation between the dentist, patient and dental technician.

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