

# Mock-Up An Old Tool Renewed

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## ABSTRACT

Mock-up technique consists in transferring to the patient's mouth the possible outcome of the treatment, by means of a tooth-colored material such as acrylic resin, composites, or bis-acryl. It can be used in every treatment that compromises the patient's look should be approved first. There are three types of ways to perform a mock-up; Direct, Indirect, and Digital. This article describes the protocol for an indirect mock-up done with bis-acryl step by step. The mock-up is a simple, low cost, and non-invasive way to approach most of our esthetic cases. Furthermore, it improves the patient's acceptance to procedures and also saves time spent otherwise making corrections on the final restoration. The mock-up is an important tool for a successful treatment sequence.

**Key words:** Acrylic resin, bis-acryl, mock-Up, provisional

## INTRODUCTION

Ownning a beautiful smile makes you feel confident to create interpersonal relationships and express yourself without restraint. Patients visit our dental practices for many reasons, being one of the chief complaints the desire to recover an esthetic and functional smile. Some patients have knowledge of what they would like to change; others do not. Maybe they find their teeth are small, yellowish, cracked, misaligned, etc., or simply because they want a fuller, whiter and younger looking smile. In most of these cases, the treatment outcome can be visualized before actually intervening the patient's teeth. This allows us to communicate better with them, understanding their specific needs and expectations, and also allows them to understand the treatment goals. By seeing the final outcome of the treatment it's more likely that they will accept different procedures because they can comprehend its purpose and also participate somehow in the decision-making of their own treatment. A mock-up is the tool that helps us achieve these goals. The mock-up technique is not new; we have been using this tool for a long time throughout direct resins and

provisionals. However, with the recent revolution in cosmetic and digital dentistry, there has also been a development of new skills and tools that can aid the practitioner to obtain more advantage from the mock-up technique.

## DEFINITION AND INDICATIONS

In simple words, a mock-up consists in transferring to the patient's mouth the possible outcome of the treatment, by means of a tooth-colored material such as acrylic resin, composites or bis-acryl. It can be used during the clinical session and then removed, or even adhered to the teeth and worn by the patient to obtain feedback at home, from family or friends. One of the differences with traditional provisionals is that mock-up's are created before any tooth preparation, orthodontic treatment, periodontal treatment or surgery is performed, they are designed to show the patients how he or she might look if the final treatment is done. It shows a real possibility and can help the patient understand the need for certain procedures he or she was not expecting to have and since it's easily removed, represents a non-invasive technique.

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Indications are multiple; basically every treatment that compromises the patient's look should be approved first. As examples, we can mention diastema closure, lengthening of the worn teeth, correction of shape and misaligned teeth, correction of severe chromatic alterations, crown lengthening, surgery, etc.<sup>[1]</sup>

A relatively novel indication of the mock-up technique is its use as a tooth preparation guide for ceramic veneers and crowns. This allows the practitioner to prepare teeth with a conservative approach since the tooth preparation is made according to the tooth/restoration's final form, and not at the expense of its present length, which in most cases are already compromised.

When there is a need for an increase on the occlusal vertical dimension, the mock-up based on a functional wax-up mounted in the articulator is a tool that allows us to verify that the design obtained is not only esthetic but also really functional in the mouth of the patient with real movements, because we can see the patient live or take videos and pictures of them, before any tooth preparation is done.

Accordingly, confectioning a mock-up is also a useful method to create provisionals while we wait for the definitive restorations.

There are different techniques and materials for different indications. Despite this, the workflow is constant: (1) Complete examination and diagnosis with proper impressions, X-rays, digital photographs, and videos; (2) wax-up of the ideal treatment outcome; (3) creation of a silicon key duplicating the wax-up; (4) filling of the matrix with the material of choice and take to the patient's mouth; (5) remove the silicon key and asses the esthetic and functional outcome; (6) evaluate the result obtained with the patient and make corrections if needed; and (7) send the information back to the laboratory (as an impression, pictures or both) to fabricate the final restorations.

## ESTHETIC ASSESSMENT

To obtain full advantage of the mock-up, a thorough assessment of the patient's esthetics is of paramount importance. This evaluation should be done sequentially; from the Facial, Dentolabial, Dentogingival, and the Dental aspect of the patient's smile. If these steps are overlooked, there is no much use of the mock-up, since the outcome from the Laboratory will not be evaluated or corrected.

## TECHNIQUES AND MATERIALS

### **There are three types of ways to perform a mock-up; direct, indirect, and digital**

The direct mock-up consists in making a preliminary restoration with composite but without any of the adhesive

procedures, just to evaluate form, contours and/or color, and then removed. The direct mock-up is done free hand, and the result depends on the clinician's skills. In addition, depending on the extension of the treatment, the amount of time it will consume starts playing an important role, which should usually not exceed the time of the normal visit. In consequence, it is recommended for simpler cases and smaller extensions. The advantage of this type of mock-up is that it can be finished in a single session, without the need of the Lab, and it has relatively low cost. After its realization, we can obtain the silicon key directly from the patient's mouth to guide the final restorations, which will be more demanding in terms of shade and opacity.

The indirect mock-up is made based on a wax-up of the case thus depends on the Lab and cannot be done during the same session. This wax-up is usually called a diagnostic wax-up, but it should be called a Treatment wax-up and has to include all our therapeutic goals. It is here when the communication with our technician is of most importance. This model has to be duplicated by a silicon key and all the details properly copied. It should be rigid enough to avoid distortion and allow proper seating; it is also recommended to extend at least two distal teeth to the segment to restore.<sup>[2]</sup>

One technique is to produce a silicon key or matrix with partial coverage from palatal or lingual; this is particularly useful with composite stratification to provide support for the application of the material and as a reference of the incisal edge position.

Full coverage silicon keys allow to use acrylic resin and bis-acryl, both auto-cured materials set while the matrix is in position. On the other hand, the use of a transparent silicon key allows the application of light-cured the composite resin.

The indirect mock-up represents a quick way to deliver functional anatomy provided by a wax-up that requires minor occlusal adjustments, making it a lot easier to establish anterior and lateral guidance.<sup>[3-5]</sup>

## THERE ARE DIFFERENT MATERIALS THAT WE CAN CHOOSE FROM

The material of choice depends on the indication and based on a case to case evaluation; how long it will be placed in the mouth, what kind of retention or cementation technique will be used, coverage need, extension, and possibility of hygiene.

Acrylic resin or poly(methyl methacrylate) (PMMA) is historically the material most frequently used for making provisionals, especially in conventional prosthodontics after the teeth are prepared. It has acceptable durability, good color

stability, and esthetics, adequate marginal adaptation, highly polishable, and relatively inexpensive. On the downside, its exothermal reaction and the free monomer represent a hazard for the tooth vitality. Its powder/liquid format requires manual mixing of the components and usually delivered with the aid of a matrix. This needs to be done carefully since the acrylic resin can easily lock into place, especially if undercuts and retentive areas are present. Isolating the tooth and gingiva with petroleum jelly or glycerin can help with this problem. The use of cold water and spray help dissipate the heat. The polymerization shrinkage has to be adjusted before cementation and usually relined to obtain proper marginal fit.

Bis-acryl resin is very similar to composite restorative materials. In fact, it's a hydrophobic resin similar to bisphenol A-glycidyl methacrylate, with acrylic resin monomers, hence its name. Available in a double-barrel tube configuration, where the catalyst and base pastes are delivered in a automixing tip as auto-polymerized form, making it quick and easy to use.

This material has improved physical properties and provides a more predictable and easier fabrication.

It is a relatively brittle material and difficult to manipulate before setting without the use of a Key or Matrix, therefore not recommended to repair if needed, and better make a new provisional instead. Bis-acryl presents low exothermic reaction compared with acrylic resin with minimal pulpal irritation, and low polymerization shrinkage, allowing proper marginal adaptation, and good retention.<sup>[6]</sup>

The addition of radiopaque glass fillers allows for less shrinkage, improves fit and occlusal wear. The paste-paste formulation undergoes a three-stage polymerization reaction. During the 1<sup>st</sup> min, the free-flowing paste adapts to the tooth surface before it becomes elastic. The next phase, is a cross-linking polymerization reaction that takes a few more minutes. At this point, the material reaches high compressive strength and hardness, allowing to be removed, trimmed, and polished before cementation. The use of this material requires less time than using acrylic resin since it has a rapid or snap setting that enables to remove it from the mouth after a minute or two, with less chance to cause damage to pulpal or gingival tissues.<sup>[6]</sup>

Composite restorative materials have superior performance since they are a definitive material, but this also makes them relatively expensive. It is hardness, and superior resistance to wear makes them an ideal material for long-term provisionals. Due to the viscosity of the conventional presentation of composites, they are difficult to carry in a silicon key and properly adapt to the teeth. Consequentially, they must be applied freehand being considerably more time-consuming. On the other hand, flowable composites can be easily used

with a key or matrix, but they have an inferior physical performance so they cannot maintain proper occlusal stability if the restoration is meant to stay in the patient's mouth for a long period of time.

## FINALLY ANOTHER NEW CHAPTER IN PROVISIONAL IS THE USE OF COMPUTER-AIDED DESIGN/COMPUTER-AIDED MANUFACTURING

Materials, which allow to create provisional restorations with superior fit, resistance, and mechanics, without the need of manual or auto mixing. This allows for a PMMA temporary restoration to function for much longer periods of time, even a year. However, this requires the use of a chair-side system or made in an indirect fashion by the Lab.<sup>[7]</sup>

The third technique to be described is digital mock-up. Its name reveals the use of digital tools to create it; Photographs, editing, and presentation programs (Photoshop, Keynote, or PowerPoint). In this type of mock-up, the possibilities are limitless, depending only on the creativity, time and skills of the user. Copy, Cut, Clone, Crop, Stamp, Blur, Mask, Animate, etc., are all basic functions that can simulate crown lengthening, diastema closures, whitening, and other pictures in a simple and non-invasive way.<sup>[8,9]</sup>

To do this, the use of high-quality digital photography is mandatory. Proper perspective, illumination, focus, color, and detail produce great images to work with. If these parameters are accounted, it is possible to superpose pictures from the previous state, the wax-up, and mock-up and produces very neat pre- and post-treatments presentations. This material has great impact on patient's treatment acceptance and is also useful for communicating with the Lab and other colleagues from our team.

The Digital Smile Design Concept uses most of these tools in the treatment protocol; Photographs, Digital Simulation, wax-up, and mock-up.

The cost of the digital mock-up is relative low because it involves no special materials. However, time and equipment already available (assuming the clinician does clinical photography and has a camera and a computer) are needed. This technique can be done quickly or slowly, depending on the user's skills. Accordingly, it can be done in the same session, or it may require a second visit. Regarding the results, it must be pointed out the importance of maintaining the treatment outcome as realistic as possible, so we create unreal expectations.

## CLINICAL STEPS FOR AN INDIRECT MOCK-UP DONE WITH BIS-ACRYL

1. Complete diagnosis: After an interview with the patient to register their needs and expectations, proper registration of photographs and impressions, allow a complete study of the case and establish a list of problems or issues to be solved in the treatment.
2. Wax-up: With a good quality impression and cast, the clinician or the lab can proceed with the Waxing of the case following the list of issues that need to be addressed. The use of a digital mock-up is of great help to assist on the wax-up.
3. Silicon key: The wax-up is then duplicated with putty silicon (polyvinyl siloxane), it should extend a pair of teeth further at each end of the wax-up to allow a proper and stable seating of the key in the patient's mouth. The buccal aspect of the key must be cut following the scalloping of the gingival margins to remove the excess of material easily and before it hardens completely.
4. Loading the matrix: The mixing tip must be kept deep inside the silicon key while loading the material, always submerged in it to avoid bubbles. The teeth and gingiva can be isolated with Vaseline.
5. Place it in the mouth, check that it's fully seated in position and keep a uniform pressure. The excess of material can be removed at this point.
6. Removal, trimming, and corrections: Remove the silicon matrix and trim the remaining excess, small bubbles that may appear can be repaired easily with flowable composite.
7. It is not recommended that the mock-up is removed and then cemented because it might fracture or alter its appearance. The excess in proximal areas gives the retention. However, it must be possible to keep proper hygiene in these areas.
8. If the mock-up needs to be kept in position for longer time, the Spot Etching technique is helpful. This is done etching a small area in the center of the buccal surface for 5–10 s before applying the mock-up. This allows extra retention.
9. Clean the surface of the mock-up with a cotton roll wet in alcohol to remove the oily layer after the polymerization. This will reveal a glossy look of the resin.
10. Open the incisal and gingival embrasures to give a natural look and allow proper hygiene. The mock-up can be characterized with effect dies for composite.
11. Eliminate excess from the gingival sulcus to give a proper emergency profile. For this a scalpel (n°12 Blade) can be used with caution; furthermore, a carbide bur of 8–12 blades can trim de excess material without affecting the tooth structure.
12. The patient can leave the office with the mock-up in place to show family and friends, and then it can be easily removed as it will fracture and chip off.

13. Final evaluation; before it is removed from the patient's mouth, the final shape must be evaluated from a functional and esthetic point of view. This is where the patient can interact and actively participate in the treatment. We can make corrections considering the patient's final comments and see if the expectations are met.
14. Duplication of the mock-up and send to the Lab to serve as a precise guide to elaborate the final restorations.

## MOCK-UP AND THE NEED OF TOOTH PREPARATION

The non-invasive property of this technique is one of its may or features, but it must be said that not all cases can be done without any tooth preparation; severe malposition or buccal placement of anterior teeth cannot be corrected in an additive approach. To correct this the model must be trimmed to do the wax-up, but then the silicon key would not seat in the mouth properly. However, there are other options for these cases; the wax-up can be done in on top of the misaligned teeth and still have a positive result in the patient in spite of the over contoured look. This also helps the patient to understand the need for certain procedures such as orthodontics.

## CONCLUSIONS

The mock-up is a procedure that has been around for a while, but thanks to new materials available and the use of digital media we can now offer a totally different result from what we could do in the past. The mock-up is a simple, low cost, and non-invasive way to approach most of our esthetic cases. The time spent is not lost since it improves the patient's acceptance of procedures and also saves time spent otherwise making corrections on the final restoration or even worse, repeating treatments. The mock-up is a vital step in the treatment sequence for a successful result and a happy patient.

## REFERENCES

1. Burns DR, Beck DA, Nelson SK. A review of selected dental literature on contemporary provisional fixed prosthodontic treatment: Report of the committee on research in fixed prosthodontics of the academy of fixed prosthodontics. *J Prosthet Dent* 2003;90:474-97.
2. Gurrea J, Bruguera A. Wax-up and mock-up. A guide for anterior periodontal and restorative treatments. *Int J Esthet Dent* 2014;9:146-62.
3. Magne P, Belser UC. Novel porcelain laminate preparation approach driven by a diagnostic mock-up. *J Esthet Restor Dent* 2004;16:7-16.
4. Magne P, Magne M. Use of additive waxup and direct intraoral mock-up for enamel preservation with porcelain laminate veneers. *Eur J Esthet Dent* 2006;1:10-9.
5. McLaren EA. Bonded functional esthetic prototype: An

- alternative pre-treatment mock-up technique and cost-effective medium-term esthetic solution. *Compend Contin Educ Dent* 2013;34:596-607.
6. Perry RD, Magnuson B. Provisional materials: Key components of interim fixed restorations. *Compend Contin Educ Dent* 2012;33:59-60, 62.
  7. Strassler HE. Fixed prosthodontics provisional materials: Making the right selection. *Compend Contin Educ Dent* 2013;34:22-4, 26.
  8. Vailati F, Belser UC. Full-mouth adhesive rehabilitation of a severely eroded dentition: The three-step technique. Part 1. *Eur J Esthet Dent* 2008;3:30-44.
  9. Vailati F, Belser UC. Full-mouth adhesive rehabilitation of a severely eroded dentition: The three-step technique. Part 2. *Eur J Esthet Dent* 2008;3:128-46.

**How to cite this article:** Heinsohn JPS, Arteaga EM, Rivera GJ, Stange VB. Mock-Up An Old Tool Renewed. *J Clin Res Dent* 2018;1(1):1-5.