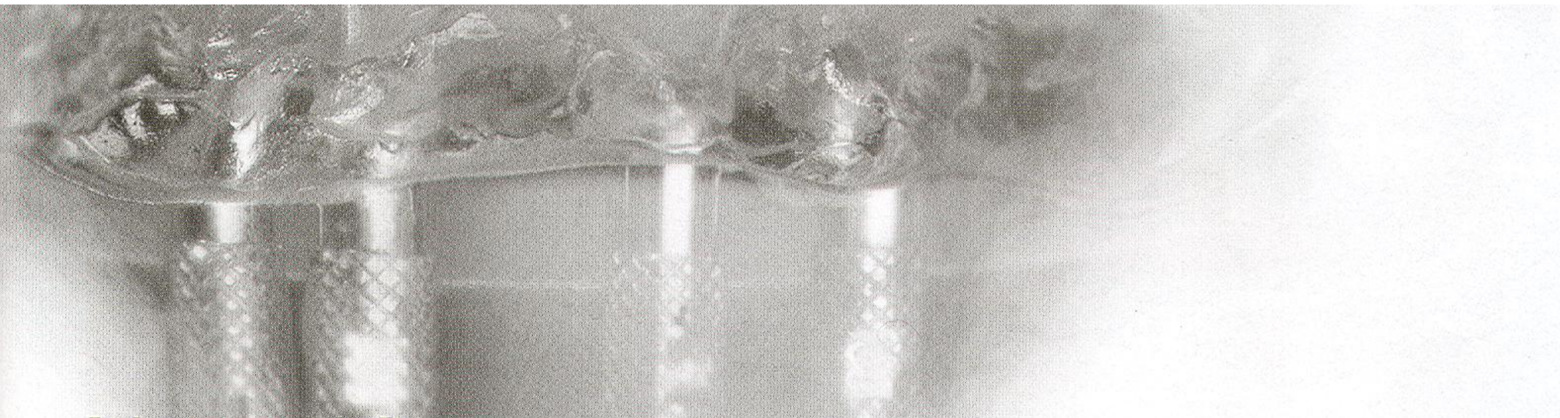


Light-curing wax by Primotec

There are Simpler Ways ...

Joachim Mosch and Andreas Hoffmann

Simplifying your dental life ... a wonderful idea in a world that seems to be getting more complicated all the time. Tight deadlines and financial constraints abound in the dental lab. Everyone seems to be discussing new materials (zirconia) and techniques (overpressing). And the new technologies (CAD/CAM) require unprecedented amounts of capital – while at the same time the dental lab is expected to be service-oriented and to make the most of its location advantage over providers of imported restorations. It must actively promote – sell! – its range of service and increase productivity, defined as best quality of finished work at highest quantities per unit of time. The authors of this report present the Metacon light-curing wax by Primotec, supposed to offer considerable time savings.

Key words: Carving wax, Light-curing wax, Metacon, Metawax, Modelling wax, Prefabricated wax patterns

So what is all this talk about simplifying your dental life? Of course, we cannot hope for a panacea or the ultimate dental world formula. But if we take a closer look at the list of practical problems we are facing and do some hard structured thinking, we will certainly find solutions capable of making our lives simpler and easier.

One promising way to meet some of the demands for productivity, speed and low cost is the Metacon light-curing wax. It had originally been introduced in 2000 as a new approach toward fast, high-quality and cost-efficient combination dentures, clasp-retained dentures and complete dentures without duplication procedures, directly on the master cast. But that was only the beginning. More and more indications were added over the years, so that the benefits of the Metacon light-curing wax can now be enjoyed in all areas of dental technology – from crown and bridge frameworks to all types of implant superstructures and pressable ceramics.

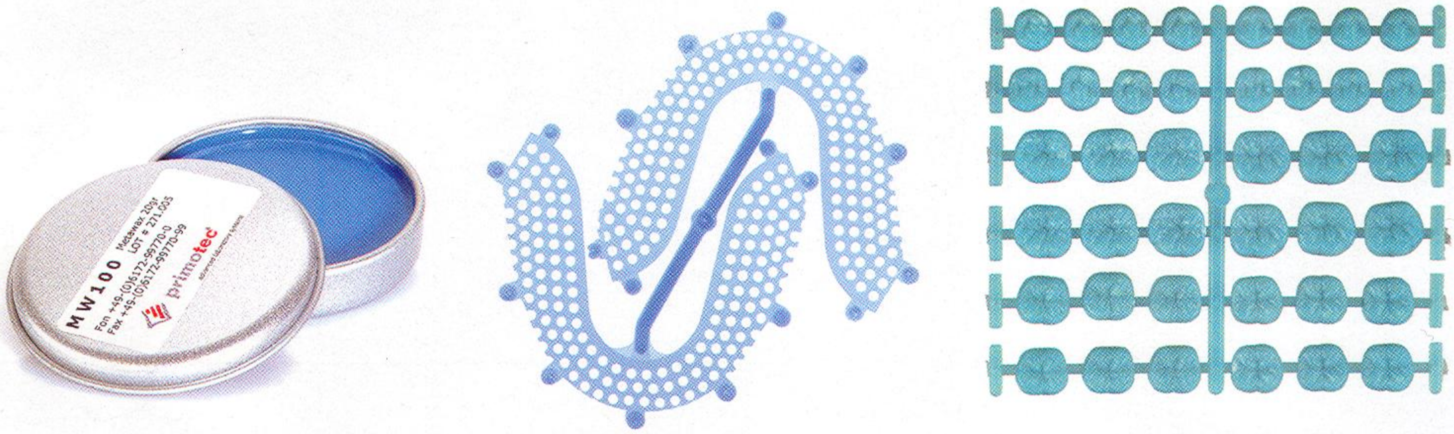


Fig. 1: Metacon carving wax and prefabricated patterns have the same basic chemical composition. This means that leftovers from the patterns can be collected and used as carving wax.

Fig. 2: Metalight light-curing units polymerize gently and distortion-free – not only Metacon wax but also many other light-curing materials

Fig. 3: Cross-cut acrylic cutters are well suited for finishing the polymerized Metacon wax

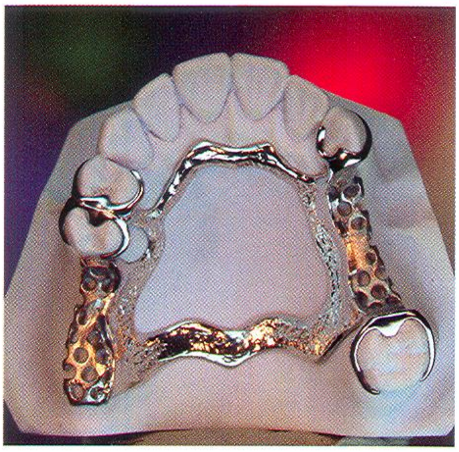


Fig. 4: "Automatic" fit, achieved with little effort

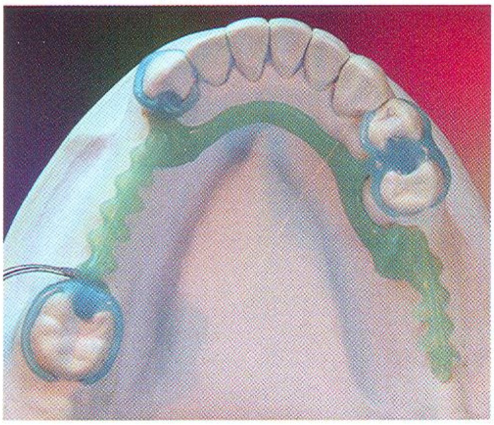


Fig. 5: Rests and clasps must always be firmly waxed to the basic design

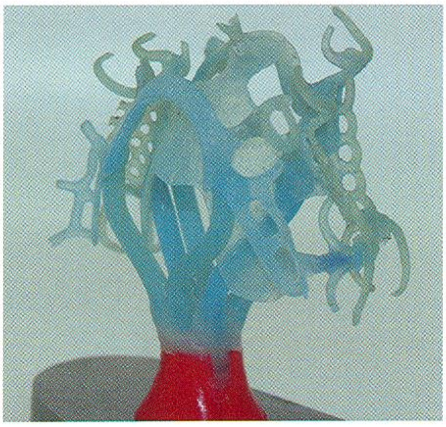


Fig. 6: The mobile magnetic cone is used to move the wax-ups to their optimal position on the muffle base

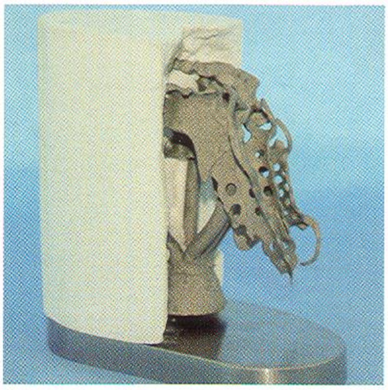


Fig. 7: A clean triple casting, only half divested for demonstration purposes. It is apparent how much investment compound can be saved, and only one casting reservoir was used.

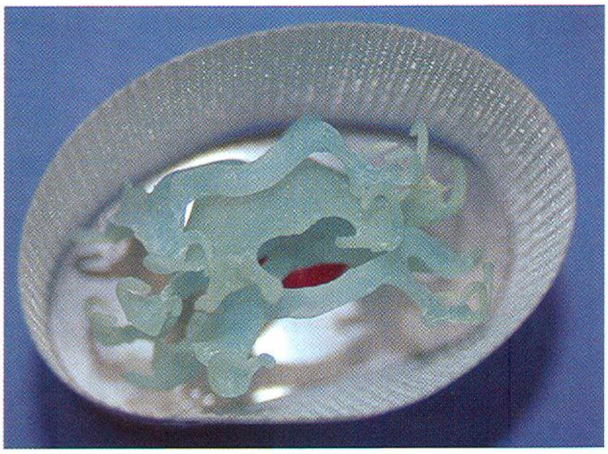


Fig. 8a: Three castings in a small muffle – other problem

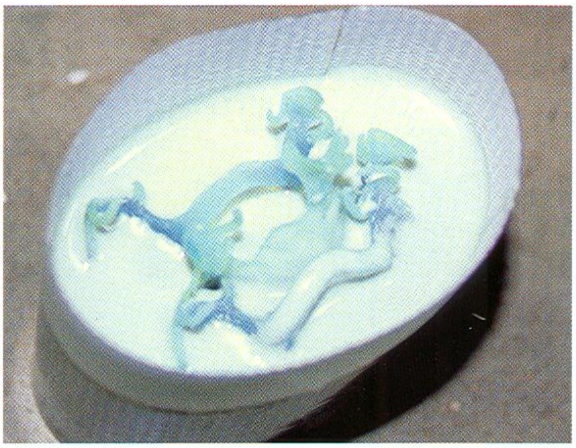


Fig. 8b: Vertical investing reduces the risk of bubble formation on the castings

The Metacon system includes the Metawax carving wax for use in the fabrication of fixed restorations. Metaform prefabricated wax patterns such as surface-grained and smooth plates, retentions, bar patterns, clasp profiles – to name only a few (Fig. 1) – are available for removable dentures. Like conventional wax, the material can be either carved or cold-formed (kneaded), as it can be plasticized at room temperature by appropriate conditioning. Once the wax-up has its final shape, it is polymerized in one of the special Metalight light-curing units (Fig. 2). Light-curing turns the wax into acrylic without causing it to lose the beneficial effects of a wax;

the Metacon acrylic burns out cleanly and completely and does not expand in the ring during pre-heating.

At the same time, the acrylic is sufficiently stable not to deform or to fracture, but still sufficiently flexible to lift e.g. a clasp-retained denture framework off the master cast without problems. The polymerized wax-ups – which for reasons of terminological tradition we will continue to call wax-ups – can be adjusted before investing (Fig. 3) in that the acrylic can be easily machined with cutters or rubber polishing wheels. Precisely adjusted resilience and direct modelling on the master cast result in a precision of fit that is almost inconceivable to improve on (Fig. 4).

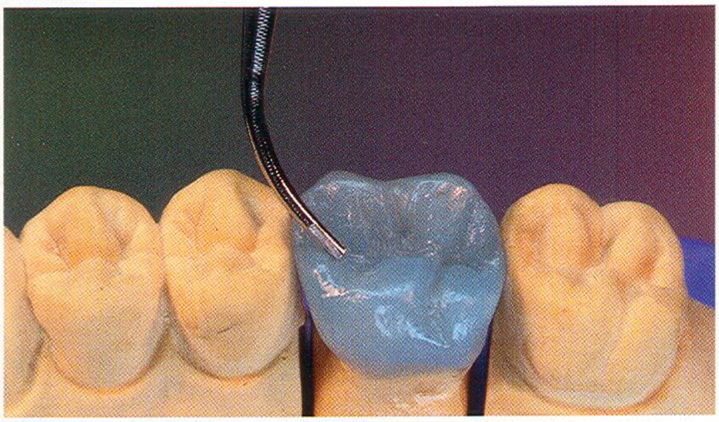


Fig. 9: The Metacon can easily be shaped with the probe tip of the electric wax knife

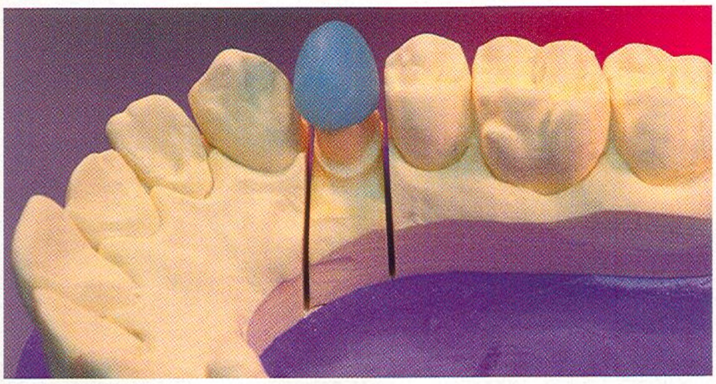


Fig. 10: This globe will be turned into a crown with fully anatomic contours in a modicum of time without heating the wax even once

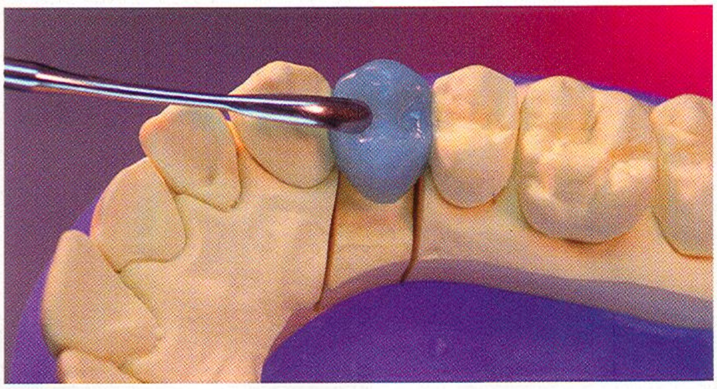


Fig. 11: Carving and shaping is done as with veneering resins, except that the Metacon wax is more stable in shape

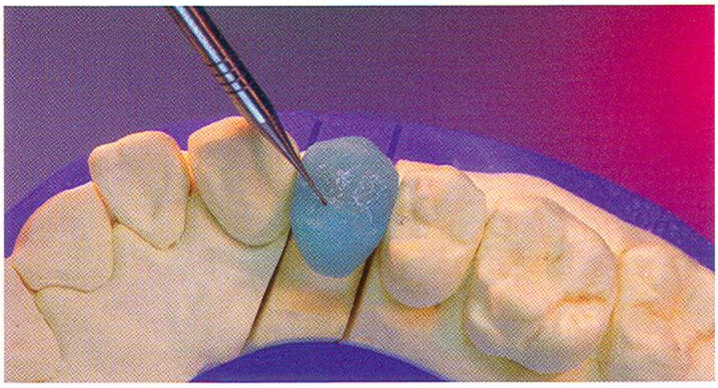


Fig. 12: Finishing is performed before investing and pressing

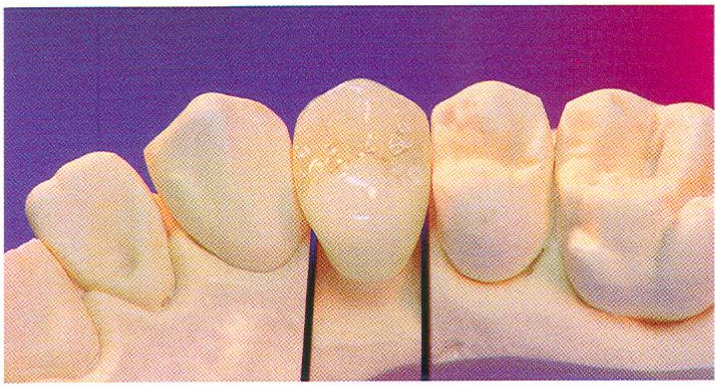


Fig. 13: The finished crown, cleanly pressed. Metacon burns out cleanly and completely and does not expand in the ring

Sounds promising – but how is a system such as this one supposed to simplify your dental life? Whereas this article is mainly dedicated to describing the use of the system in the fabrication of fixed restorations, we will first take a short excursion into the world of clasp-retained dentures that demonstrates how the Metacon system can be used to address the challenges mentioned (productivity, speed and low cost).

The wax-up is done on the master cast (Fig. 5), saving duplication material (silicone), investment compound (duplicate cast) and time. Most of the finishing is done before casting; clasp rests can also be designed directly on the articulator ahead of casting, which again saves time and cutting instruments. The wax-ups are invested vertically in small muffles (which require at least 50% less investment compound) or even several to a muffle, as customary for crowns and bridges (Figs. 6 to 8). This not only saves lots of time, but also enormous quantities of investment compound and alloy, reducing the pressures of time (thanks to shortened procedures) and cost (thanks to considerable savings on materials), thus increasing productivity (better fit, more castings per unit of time).

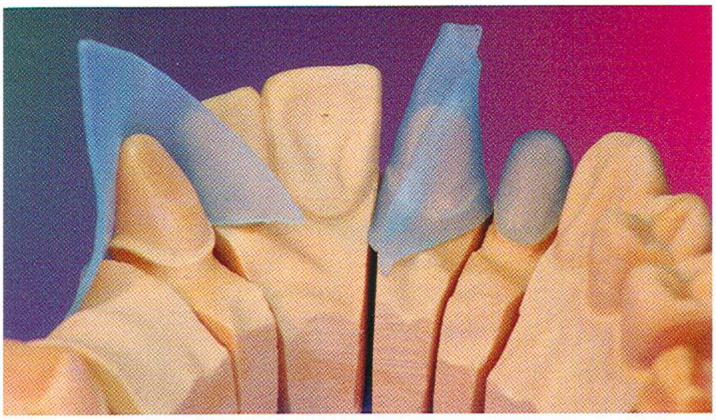


Fig. 14: A triangle is cut from a smooth 0.35-mm Metacon wax plate and adapted to the die

This sounds almost trivial, and in and of itself it is. But as always when trying to simplify an established procedure, there is a problem: you have to actually do it, and that includes overcoming the one's own resistance and their resistance of the staff. But more about that later.

Waxing up with Metacon

In principle, the light-curing wax can be carved conventionally with an electric wax knife (Fig. 9). But an alternative procedure has proved even more beneficial, given a bit of practice – and that is cold-forming the material with one's fingers or suitable instruments such as those used in the resin veneering technique, which is facilitated by the putty-like consistency of the material.

In general, the wavelengths of light that the photo initiators of the Metacon wax react to were chosen to allow the material to be worked on openly under ordinary workbench lighting for several hours without triggering the polymerization process.

Cold-forming

A pressable-ceramic crown is a good example of how the cold-forming technique works. Once the die has been properly prepared, the Metacon wax is rolled to a globe between the fingers, placed on the die from occlusally and adapted toward the cervical aspect (Fig. 10). The anatomic wax-up is performed just as for resin veneers, that is, costs are pushed toward their correct position, whereas fissures are carved with an appropriate instrument (Fig. 11). But since the wax has a much more stable shape than veneering resin, the proper shape is created quickly and easily. Following polymerization in the Metalight light-curing unit, the crown is largely finished during this acrylic phase, including even the proximal contacts (Fig. 12). That makes sense, because acrylic is easier to cut than ceramics. No significant adjustments will be necessary after pressing, so the finishing step is rapidly completed. The result is a pressable-ceramic crown with an excellent fit overall and at the margins, fabricated in a highly efficient process (Fig. 13).

Like crowns waxed up to full anatomic shape, copings for subsequent ceramic or resin veneering can also be cold formed with Metacon. To do so, a small Metacon wax ball is shaped and adapted from the incisal edge or occlusal surface towards the margin. Of particular interest is the possibility to check the wall thickness after polymerizing using a calliper compass and to adjust it to the required thickness before investing and casting, if required.

Another very practical approach to fabricating copings – besides the conventional drop-by-drop application, which is really too time-consuming – consists of adapting a

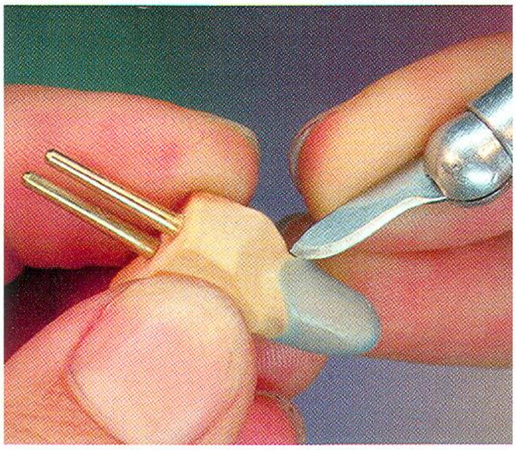


Fig. 15: The ground margin should end at the preparation margin even at this early stage

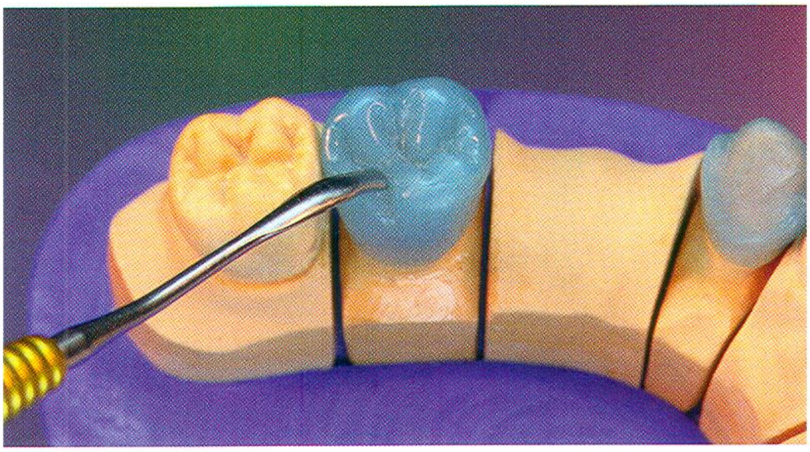


Fig. 16: The canine scallop has been waxed up, and the molar was cold-formed

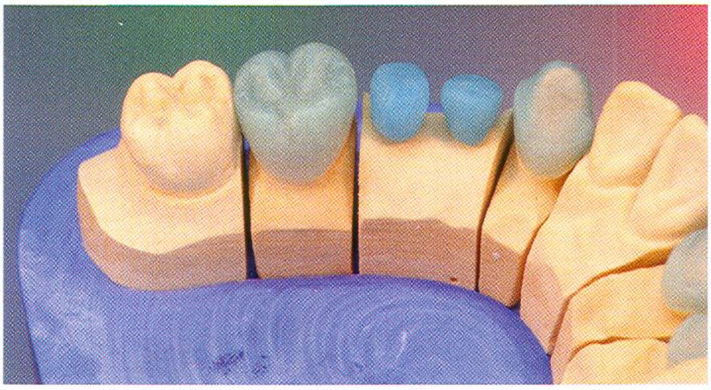


Fig. 17: The abutment crowns are finished first; only then are the pontics placed and connected to the abutment crowns

Fig. 18: The bridge has been polymerized and finished

smooth plate of predefined thickness to the die (Fig. 14). Here, too, most of the modelling is done by cold-forming with the fingers, and the wax knife is used only on the seams. Any excess below the preparation margin is cut off cleanly, with material added to deficient margins as required (Fig. 15). The palatal scallops can be waxed up before or after curing. The molar crown (Fig. 16) was cold-formed from a globe, as described above, because this goes much faster, given a bit of practice in the technique.

Note: Hot and cold forming techniques can be combined at will. Even conventional wax can easily be added after polymerization if desired. A very practical approach has been to light-cure all abutment crowns individually before connecting them to the bridge pontics. In this way, each individual abutment crown can be finished meticulously in the proximal and cervical regions before the pontics can get in the way (Fig. 17). Once the pontics have been placed and connected to the abutment crowns using wax or Metabond adhesive, the entire design is once again light-cured and finished almost to completion (including the occlusal and proximal contacts). The bridge could now either be sent back to the dentist for the try-in (Fig. 18) or find its way to the scanning frame of a copy-milling unit or a laser scanner (Fig. 19).

Casting

In the case presented here, the bridge was to be cast, so it was first sprued using the Primoclick system (Fig. 20) to optimize the flow during casting and to save alloy, since the Primoclick sprues are only thickened where the casting piece will draw melted alloy during cooling (feeder or hot-top principle). This procedure yields reproducible and homogeneous casting results – each time (Fig. 21).

The use of the Metacon system alone all but eliminates any rocking action of the framework after casting, because the polymerized material is impervious to temperature changes and cannot bend irreversibly as it is lifted off the cast, unless the technician has committed a major blunder. Casting will always be foolproof when using Primoclick (Fig. 22), provided of course that other casting parameters such as melting temperatures etc. are correct.

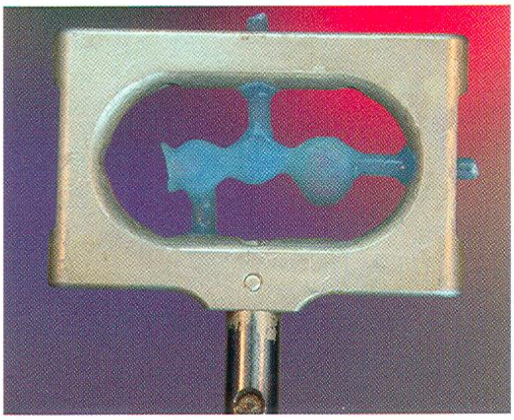


Fig. 19: Light-cured Metacon wax-up in the Cercon scanning frame

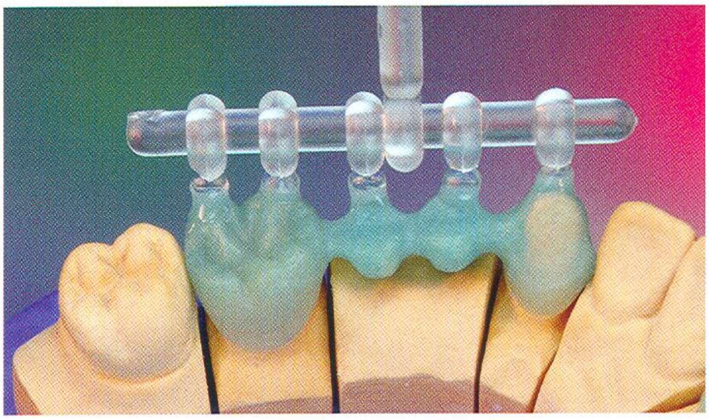


Fig. 20: The bridge has been screwed using the Primoclick system – another tool to increase productivity

Fig. 21: A perfect casting result obtained with less alloy

Fig. 22: No rocking action. A perfect fit is standard

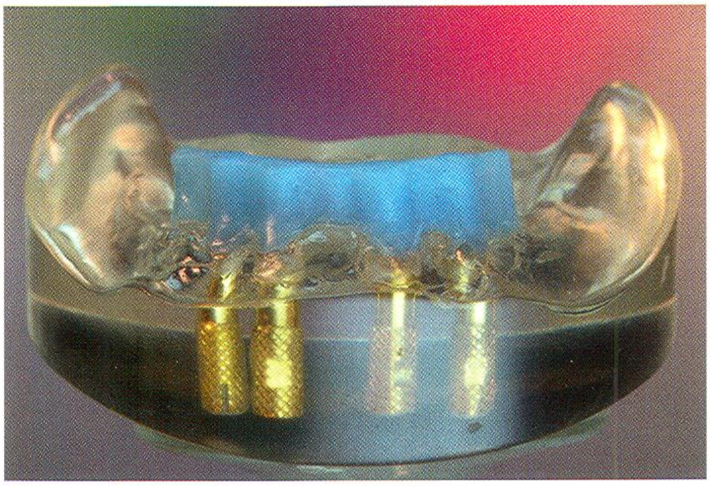


Fig. 23: The basic shape of the bar is cold-formed in Metacon wax

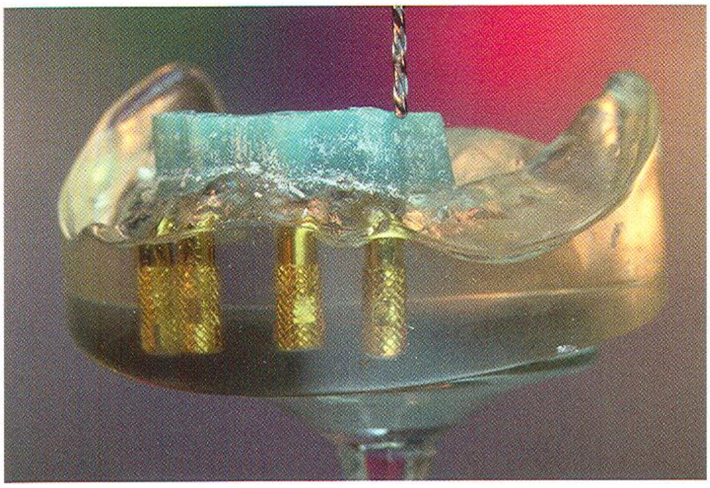


Fig. 24: The light-cured material is very easy to mill

Implant Prosthodontics

How does the "simplified dental life" affect implant prosthodontics? This can be exemplified by a mandibular restoration with a primary impact-supported cast bar, secondary electroplated copings and a tertiary framework, also cast.

Once the implant abutments (resin cylinders) have been placed and wetted with Metabond adhesive,a corresponding quantity of Metacon wax is cold-formed around the abutments to obtain an approximate shape (Fig. 23) and polymerized. This goes quickly while still yielding a very good fit.

The reasons are obvious. One, the Metacon wax itself does not exhibit a clinically relevant amount of polymerization shrinkage; two, cooling contraction does not occur because the wax is not heated in the first place; three, the Metalight light-curing units are designed to ensure gentle and stress-free light-curing at constant low polymerization temperatures.

As with all light-curing materials, polymerization will create a so-called dispersion layer at the Metacon surface, which is removed before milling (Fig. 24). Once the bar is milled and finished (Fig. 25), it can be sent out for the try-in. It is a great advantage that the cured material tends to fracture rather than deform if the bar does not exhibit a passive fit in situ. In that case, the Metacon wax-up will be reconnected in the correct position on a new master cast

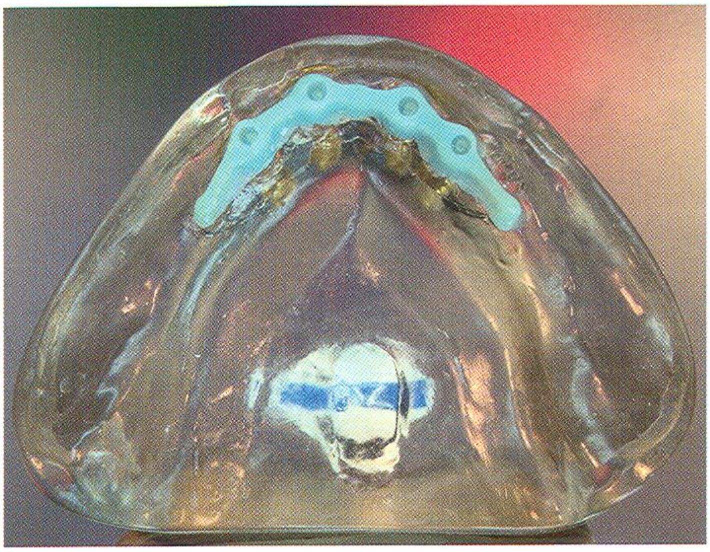


Fig. 25: Acrylic is easier to mill than metal. The finished implant-supported bar

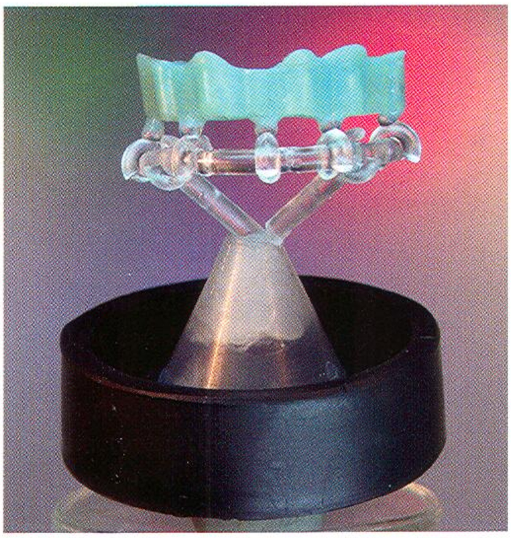


Fig. 26: The Primoclick clips are placed on the "thicker" aspects of the wax-up, because this is where additional melt will flow during cooling

Fig. 27: Not much left to do on this bar, except cutting off the sprues and cleaning the edges

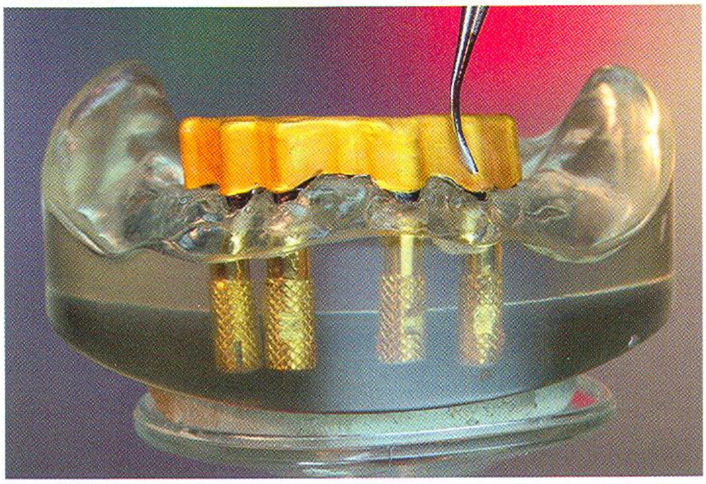


Fig. 28: The electroplated coping is covered with a very thin layer of pink wax

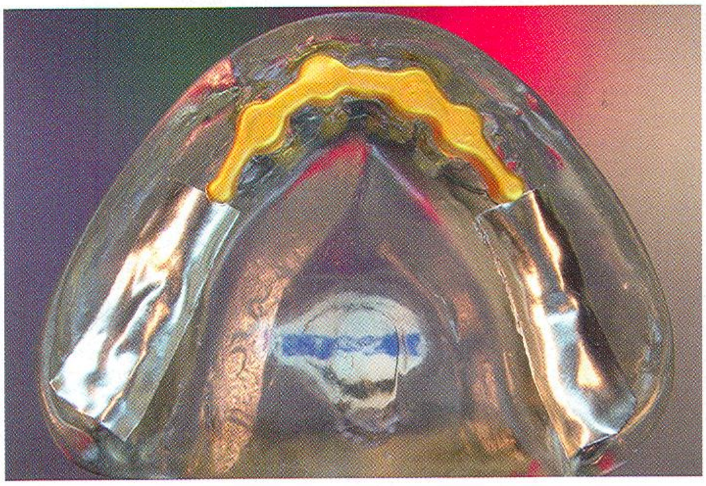


Fig. 29: Retentive areas can be lined with tin foil or spacer wax

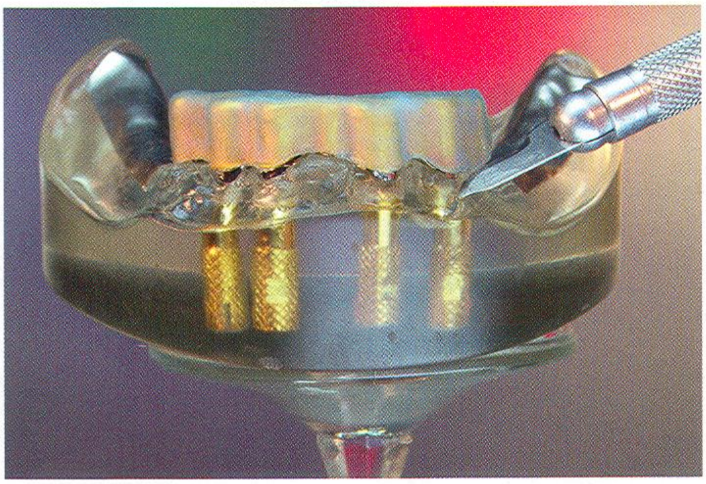


Fig. 30: The smooth Metacon wax plate is cut along the lower edge of the bar

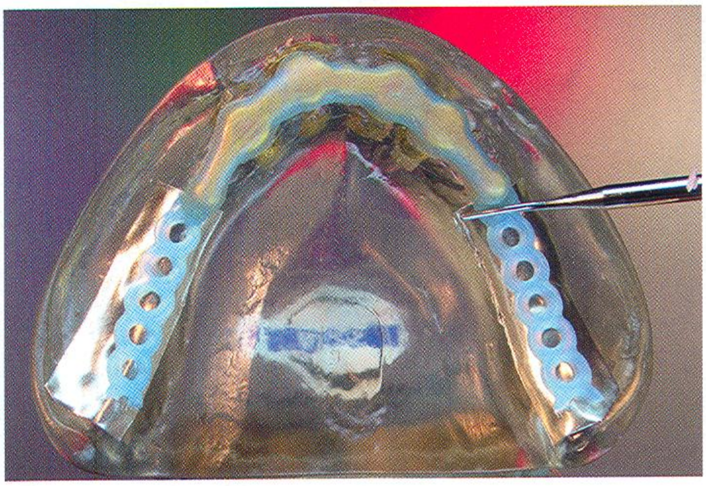


Fig. 31: The retentions are carefully connected with a smooth plate using the electric wax knife

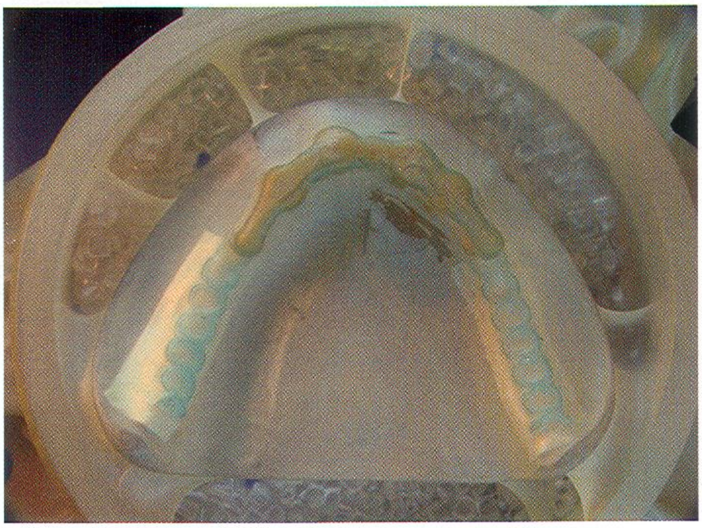


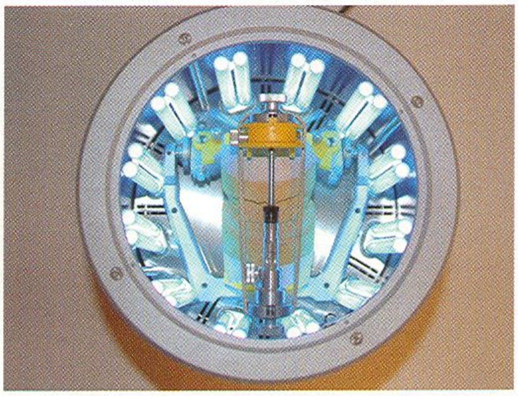
Fig. 32: The wax-up is adapted in the Metavac vacuum suction device, ensuring close adaptation by a controlled vacuum

before metal casting (Figs. 26 and 27). It goes without saying that separating and reconnecting is much easier at the acrylic stage than after casting.

Once the bar and the electroplated secondary copings are completed, preparations for the wax-up of the tertiary framework can begin by covering the electroplated copings with a very thin layer of pink wax (Fig. 28). Retentive areas are lined with tin foil (Fig. 29).

The tertiary structure is designed in two steps. The first step consists of adapting a thin and smooth Metacon wax plate, 0.35 mm in thickness, to the electroplated copings, making sure that it seats cleanly without gaps or cracks. Any excessive wax at the lower edge of the bar is trimmed with a slightly heated scalpel (Fig. 30). Next, the retention grids are placed on the areas of the alveolar reach covered by tin foil and connected to the taped material on the electroplated copings with wax (Fig. 31). For a perfect passive fit of the structure, the wax-up is adapted in the Metavac vacuum suction device, ensuring close adaptation by a controlled vacuum (Fig. 32).

Figs. 33 and 34: Sufficient space for one or more Metavac devices was one of the requirements during the development of the Metalight Classic and Trend units



Polymerization

The construction inside the Metavac device is polymerized in a Metalight Trend or in a Metalight Classic – the Metalight Mini being a rather compact workbench unit that does not have the capacity to accommodate the Metavac container. Because of the dimensions involved, the Metalight units were designed as part of the Metacon system (Figs. 33 and 34). Other inherent requirements of the light-curing unit in order to ensure seamless polymerization of Metacon wax include:

- The wavelength of the light source must be precisely attuned to the photoinitiators of the material. This allows the material to be processed under ordinary workbench lightning for a considerable period without triggering polymerization, while at the same time ensuring relatively rapid curing once in the curing unit.
- The curing temperature must not significantly exceed the room temperature, thus requiring efficient internal cooling inside the device. Without cooling, the heated Metacon wax might deform before polymerization.
- The duration and intensity of the polymerization process, which is gentle and relatively slow (10 minutes) in the Metalight units. Stroboscopic units are much too fast by comparison and too intense, and they develop too much heat.

The entire wax-up is lifted off the master cast after polymerization after first separating the retentions from

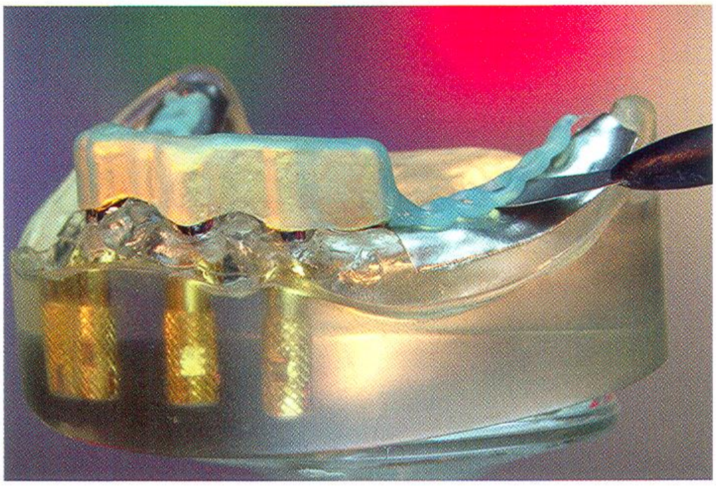


Fig. 35: Lifting the polymerize structures is easy once the technician has developed a bit of a feel for this

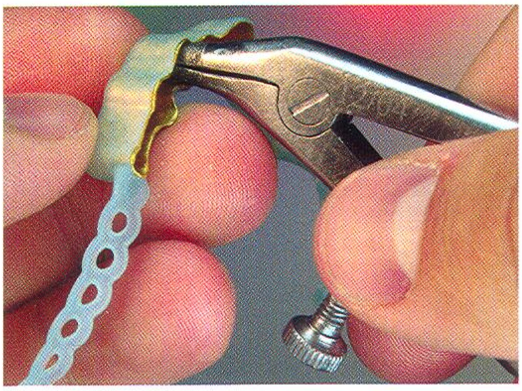


Fig. 36: The pink wax between the electroplated coping and the tertiary framework is heated through the gold layer by hot telescope pliers. The electroplated copings will drop out of the polymerized wax-up.

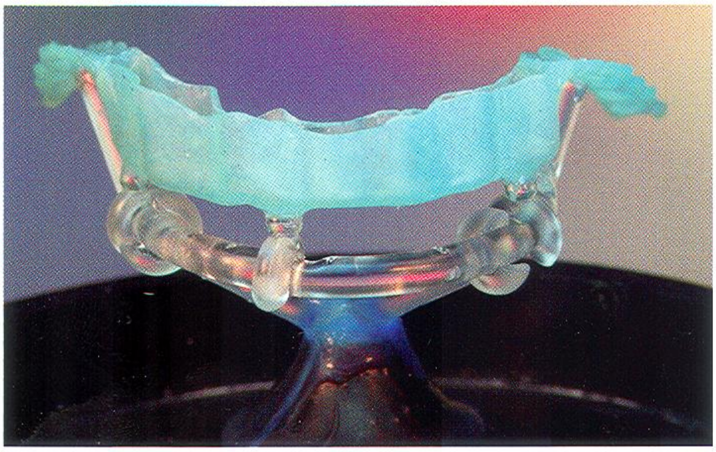


Fig. 37: This wax-up, too, is sprued using Primoclick

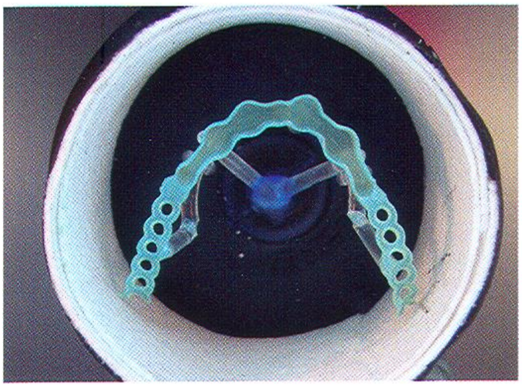


Fig. 38: Instead of investing in the vertical Metacon muffled system, conventional horizontal investing is also possible (here a size 6 muffle)

Fig. 39: Speed-cast, divested and sandblasted tertiary structure

Fig. 40: Once the electroplated copings have been adhesively attached to the tertiary framework, the aesthetic stage of the process can begin

the tin foil. It is important not to use any instrument as a lever but to lift the wax-up only to the point that allows us to enter between the retention and the tin foil (Fig. 35).

Once the retentions are separated, the entire wax-up complete with the electroplated coping can be easily lifted off the bar. The wax-up and the electroplated copings are best separated by heating the gold from inside, for instance using telescope pliers. This will melt the pink wax introduced at the preparatory stage, and the electroplated copings will drop out of the wax-up (Figs. 36 and 37). This type of wax-up does not usually require a lot of finishing, so that the technician can proceed immediately with sprueing (Primoclick), investing (size 6 muffle with a double fleece lining) and cast using the speed-cast process (Fig. 38).

The combination of the light-curing Metacon wax and the Primoclick sprueing system yields excellent casting results, time and again (Figs. 39 and 40), with Metacon generally requiring maximum investment expansion.

Conclusion

This article intended to show a way to help address some of the pressures haunting dental laboratories today, pressures related to productivity, deadlines and cost efficiency.

The Metacon system indeed constitutes a problem-solving approach. The light-curing wax can serve a great variety of purposes in the lab; it helps save time and material (and thereby cost) while at the same time improving the quality of the finished work – and at very low initial expenses.

That sounds almost too good to be true, so where is the problem? Well, there is a problem – habit. As with every new technology, technicians have to learn how to deal with the new material, to get used to it, to adapt their routines and their way of thinking. It can be done – better than one would think at first. But you have to really want to change and to motivate yourself and your staff accordingly.

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