Technological Innovations Related to Dentures

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This article describes the steps related for the fabrication of removable dentures made with a new type of resin Curing system (V.L.C.). The protocol is part of the systematic integrated TRE, which has as its objective the replacement of methyl methacrylate with an auto- thermo-polymerizing (P.M.M.A.) that may be used in all procedures of the laboratories: removable prosthesis, fixed, orthodontics, with the these resins V.L.C.
Introduction

The procedures for the construction of a denture or orthodontic appliance may be affected by the characteristics of the materials used.

Among the materials used there are the dental resins; the most often used in this field are those based in P.M.M.A. They tend to notoriously have a number of significant operational issues in the different processes and poor biocompatibility for patients and operator as well. Historically there have been many attempts to replace resins based P.M.M.A. for these reasons but always with poor result. Today, on the basis of results obtained from the 2006 research I was involved in we realized as a group of Italian dental technicians that we can say that the new technology V.L.C. has allowed Denturists and dental technicians to enter into a new era. The system allows the Denturist to make devices completely biocompatible to patients in areas such as removable and fixed prosthesis and orthodontics (Figs. 1-3). The application of the system V.L.C. described in this article relates to the procedures used by the Denturist which allows for results clearly superior to those achieved with methods which provide for the use of other types of resins.
Materials and methods

The operational phases described in this article have been appropriately divided, showing step by step the work phase in the laboratory. Pouring preliminary models 7, 8: The primary models are obtained from the alginate impressions and used for the construction of individual custom trays, indispensable for a correct recording for the final impression.

Custoum trays and Impressions:

The custom trays are modeled into their form and polymerized using special equipment, reducing the working time and the subsequent stages of work relating to the polymerization of the resins. These trays were designed to be used for the secondary impressions with a technique that involves the use of a silicon-based material. The trays were trimmed approximately 2mm short of the peripheral border to allow for a border molded functional impression (Figs. 7-8).
Pouring secondary models

Before pouring the secondary models, the impression are boxed with wax to reproduce the details of the impressions for the future dentures (Fig. 9).

Constructing base plates

The master models at this stage, are used for the construction of the base plate, which plays a fundamental role in the proper performance of the successive phases of work. The base plates are made with a technique innovative and easy to apply which
allows the Denturist to achieve extreme accuracy. The transparency of the resin used also facilitates the positioning of the denture teeth (Figs. 10-13).

**Articulation**

Once the denture bases are checked in the mouth and maxillary-mandibular relations obtained, the base plates are used in laboratory, for positioning (FIG. 16 FIG. 17) on a semi-adjustable articulator. This step is performed in two stages. The mounting begins with the upper using a facebow then the 'lower with the base plates. These contain all the information necessary for the positioning of the artificial teeth (Figs. 14-17). The selection of the artificial teeth is determined on the basis of...
Anterior and posterior teeth are manufactured with an newly advanced technology and manufactured using INPEN, evolution PMMA that have compatible characteristics.

Setting artificial teeth

Anterior positioning of the teeth takes place according to the individual occlusal plane and markings. It starts with the maxillary anterior teeth according to the references on the bite block recorded previously by the Denturist. Mandibular anterior teeth are positioned following the occlusal rims. With the aim of acquiring more information, the mandibular posterior teeth are not set for the try in appointment.

We see here two occlusal rims with the posterior occlusal lower;

- The mounting of the maxillary posterior teeth;

The mandibular reference lines, which could be used to control the vertical dimension occlusion (VDO) (Figs. 18,19)

Positioning artificial teeth for final approval

After the try in to assess the aesthetics, phonetics and vertical dimension, we complete the positioning of the mandibular posterior teeth taking into consideration any necessary changes. During the final try in the Denturist should verify all the aesthetic and functional aspects of future prosthesis. (Figs. 20-22.)

Finalization of the dentures

After the approved try in we are going to finalize the dentures. Here I will discuss the detailed steps of polymerization on the maxillary and mandibular denture bases using the same technique. We prefer to perform the transformation of the prosthesis resin in two stages for greater control and the possibility of controlling possible changes during the polymerization step. During the first stage we have to remember the initial position of the articulator pin. We use as a landmark. After securing with the wax to the base on the models we make an occlusal matrix on the articulator making sure the pin of the articulator keeps touching the plate. After the matrix is made we take out the teeth and we clean the wax and the same with the models. Once dry we are going to apply a separator. Retention holes are drilled into all teeth before positioning and fixing them into measurements performed using the patient’s facial features. The anterior teeth used on this case have a high aesthetic value thanks to a superficial texture and natural morphology. The posterior teeth have an occlusal morphology that allows for easy use thanks to the identification of occlusal keys that allow for lingualized occlusion with excellent functional effects and aesthetics.
the matrix with proper resin. Once completed we proceed to the final step. The base is placed back on the articulator opposing it on the matrix with teeth in position using a polyethylene sheet to prevent the two resins from sticking together. Also in this step we must carefully check that the pin of the articulator is in contact with the plate before the final polymerization (Figs. 23-29). After completing the polymerization, the base is check on the articulator to ensure the adaptation of the base to the surface of the teeth and the correct positioning of the pin on the articulator plate. Once verified we apply a resin to the base and in particular to the surfaces of the teeth. The base is set back on the articulator. With the base and the matrix on the articulator, it is time to warm up the resin. Once the resins have been softened we close the articulator until it contacts with the base. Further resin is added when the articulator is closed. The resin solidifies on cooling and then can proceed with the removal of matrix from the articulator. In the end we verify that the pin of the articulator is still in the initial position. This confirms that everything is accurate as when the protheses were in wax. In this phase you can still easily remedied errors because the resin remains in a malleable stage (Figs. 30-35). After modeling, the prosthesis is inserted in the first a heating oven, to condition the two materials used, and then joined and placed in a light curing unit completing polymerization.

After this stage, the prosthesis are returned back to the articulator and checked for occlusal discrepancies. These resins are very precise so errors are generally very minimal. Next we proceed to the finishing and polishing. This step is shorter and simpler compared with older materials used before. Due to the absence of the plaster mold during curing, the details of the
dentures are much sharper and cleaner. The following pictures illustrate the results of this case produced using the new V.L.C. Revolution System THREE (Figs. 45-46).

Discussion

The advantages of resins V.L.C. are related to their characteristics and physico-chemical, better than the PMMA (data provided by the manufacturer). This protocol highlights these characteristics:

1) The processing times are reduced thanks to a very precise and to a perfect control in all work stages, avoiding, for example, grinding of the teeth after the polymerization.

2) The materials are completely workable all the time that we need; the process of polymerization starts only when they are inserted into the light curing equipment.

3) The process is very ergonomic, since the transformation is direct and does not require use plasters, flasks or other.

4) Production costs do not change; the cost is slightly higher than PMMA based materials but excess material is recovered and stored for future use, without any waste.

5) With products made with V.L.C. you can easily intervene with readjustments, during any stage until that work has been completed.

6) The use of the products V.L.C. safeguards operators from serious side effects related to the use PMMA.

7) The use of these products allows V.L.C to provide patients with devices completely biocompatible.

Conclusions

The opinions presented are the results of years of work and studies along with the collaboration of technicians, manufacturers and industry leaders without which this article would not have been possible. Considering the many departments that use PMMA base materials in dental laboratories, it is safe to say that this technology and associated
protocols may one day solve issues related to the use the P.M.M.A. Great benefits will be seen for dental laboratories, dental practices and patients.

Products:
Product lines V.I.C. referred to are: Triad®, Radica®, Eclipse® and In : Joy®
The lines of teeth manufactured with technology Inpen and are Genios, Executive.
These materials are produced and distributed by Dentsply.

About the author

Massimilano Petullo received his diploma in dental Technology in 1985. Since 1992 he owns a dental laboratory specializing in removable prosthesis, as well as being in charge of various management positions for Antlo. He is an expert in the dental production processes and provides consulting and training to dental laboratories looking to become accredited and aimed at achieving high quality work. He is a member of Antlo Formazione, and a member S.I.T.E.T. (Societe International Traitement Edention Total). He has lectured nationally and international and teaches courses on removable dentures, dental resins and their uses and applications.

He is the author of numerous scientific publications. Since 2006 he has been doing research on a new generation of dental resins that have a main characteristic of extreme biocompatibility. He has worked with several leading companies in the dental industry, as a technical-scientific consultant and currently works with the group Dentsply Prosthetics divisions in Italy and International.