

# Fabrication of Total Dentures Using Thermoforming Technology

<sup>1</sup>Mihaela Varneva, <sup>2</sup>Milen Kostadinov

<sup>1</sup>Associate Professor, Dental Mechanics Department, Medical College, Medical University - Varna, Bulgaria

<sup>2</sup>Dental Technician, Medico-dental Center, Faculty of Dental Medicine, Medical University - Varna, Bulgaria

**Abstract** - The only way to restore the masticatory function in cases of complete edentulism is the placement of a total dental prosthesis. There are several options for its retention in the oral cavity and the easiest way is by using the simple plaque prosthesis. In cases of patients, who have lost all their teeth a long time ago, a severe atrophy of the alveolar crest is observed, which makes it difficult to retain and stabilize the prosthetic structure. This fact provoked us to look for a way to overcome this discomfort and provide normal chewing function in similar cases. The present article aims to present cases from our dental practice, which includes thermoforming technology in the fabrication of total dental prostheses. In order to achieve this goal literature sources were studied, an experiment was conducted, patients were observed, photographic material was collected and both patients and dentists were asked about the outcome of the experiment. It has been found that the fabricated total prostheses not only have very good aesthetics, but are also very stable during oral function and are steadily retained in the oral cavity.

**Keywords:** Total dentures, Dental thermoforming, Laboratory protocol, Observation, Dental practice, experiment.

## I. INTRODUCTION

Total dentures allow people who have lost all their teeth to overcome the psychological barrier and social alienation by enabling them to communicate, smile and eat normally.

The demand and supply of dental prostheses is increasing with the aging process of the population and the needs of dental care for such patients [5].

Elderly patients often express dissatisfaction with their removable dentures. The functionality and durability of a complete prosthesis are extremely important to them. Aesthetics is also considered important but does not have a main role for adult patients. They are more interested in the process of properly chewing and enjoying food [2].

The functional and aesthetic creation of prosthesis for a completely edentulous mouth is a difficult and complex process. The biggest challenge in fitting total dentures is their

retention and stability during their target function. Generally, they are held in position by the natural structures and tissue features of the oral cavity such as mucous membranes, soft tissues, muscles [1,3,7]. The support depends on the scope of the prosthetic field. The larger it is, the better the support and the minor the overloading of the tissues under the prosthesis are [1,2].

The stomatognathic system of adult patients' changes after the complete loss of teeth: the surface of the oral mucosa reduces its elasticity, the masticatory muscles and alveolar bone atrophy and the innervations functions with delayed reflexes and it is difficult to perceive new chewing patterns. Patients adapt more difficult to the complete dentures [2].

There are different materials and technologies for making dental prostheses for completely edentulous patients. Some of the materials on the market are ThermoSens (2011) and Valplast (1954) – a high class dental prostheses. They are not as hard and brittle as acrylic and this gives the dentures elasticity and for this reason they are called "flexible dentures". The advantages of these products are expressed in the avoidance of the main problems which are typical to acrylic prostheses considered a classic among prostheses. They are made of a hard artificial material called polymethyl methacrylate. They have been used for a long time and are the most common type of total dentures. Like any construction known in dental prosthetics they have both advantages and disadvantages. The advantages are several: the technology and the material used for their fabrication have existed for a long time and a large amount of clinical data and experience have been accumulated; acrylic is relatively cheap; it is possible a single prosthesis to be reworked if necessary or, if broken, to be repaired easily and quickly. We can mention the following disadvantages: the material used for the fabrication is a relatively hard material, but at the same time fragile, and with the years of use of such dentures, these properties become more and more accented and when exposed to tension, they can easily break; allergic reaction may occur in some patients [6].

Despite the above-mentioned disadvantages, plaque prostheses (made of polymethyl methacrylate) are still widely

used in our country, due to the continuous increase of the elderly population, the majority of which are among the poorest and most insolvent citizens in Bulgaria.

## II. AIM

The aim of the present article is to present a laboratory protocol of the experiment carried out on cases from our dental mechanics practice, in which we have used thermoforming technology as a part of the stages for the fabrication of total dentures.

## III. MATERIALS AND METHODS

To achieve the goal of the present study we have studied literature sources and we have applied practical experience from long years of dental mechanics practice. We have also conducted an experiment – we have fabricated total dental prostheses using thermoforming technology – and have observed three cases of patients. In addition, we have collected photographic material which is partially presented in the article. We have talked to the patients and the dentist about the outcome of the experiment.

We have found that the laboratory protocol of the conducted experiment includes 19 steps. Some of the steps are standard in regard to the familiar technology for the fabrication of a simple plaque prosthesis in case of total edentulousness.

### Laboratory protocol:

- 1) Casting of models from hard plaster – third class.
- 2) Forming the base of the models and delineating the borders of the prosthesis.
- 3) Making a template and bite shafts and sending them to the dental office to determine the patient's bite.
- 4) Placing the model in the granule container and pulling the foil.
- 5) Releasing the foil from the model and cutting along the borders of the prosthesis.
- 6) Placing the template and the bite shafts (which have been received from the dental office) on the working model and fixing the two models to each other.
- 7) Orientation in articulator/occluder.
- 8) Removing the template and placing the model on the already cut foil.
- 9) Making of retentions along the ridge of the alveolar ridge.
- 10) Arranging the artificial teeth, articulating and modeling with wax the body of the prosthesis.



Image 1: Foil drawn on working models



Image 2: Foil drawn on working models



Image 3: Prostheses fixed on the lower arm of the cuvette for rebasing

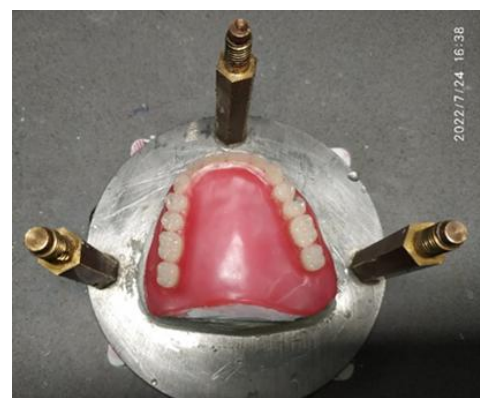


Image 4: Prostheses fixed on the lower arm of the cuvette for rebasing

- 11) Releasing the working models from the articulator/occluder.
- 12) Fixing the working model to the lower arm of the cuvette which is used for rebasing.
- 13) Covering with laboratory silicone the entire prosthesis, releasing the tips of the tubercles (as shown in photo 5).
- 14) Pouring with plaster and placing the upper arm of the cuvette while tightening the nuts on the pins.
- 15) Removing the silicone key and removing the wax.

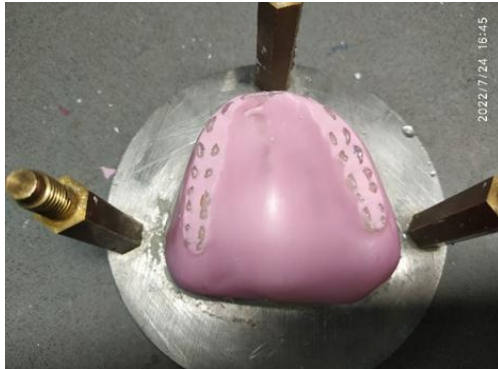


Image 5: Modeled upper total prosthesis covered with laboratory silicone



Image 6: Cleaned wax and preparation for placement of plastic on a lower full denture

- 16) Placement of self-polymerizing plastic, closing the silicone key and the upper arm of the cuvette tightening the nuts.
- 17) Placement in a vessel for polymerization in an aqueous environment under pressure.
- 18) After completion of polymerization, releasing from cuvette arm.
- 19) Cleaning, polishing and washing the finished prosthesis.

#### IV. RESULTS AND DISCUSSION

In 2018, for the first time in the National Framework Agreement in Bulgaria in the package for dental activities, only for dental offices, manipulations and activity to restore the function of the chewing apparatus are included in the case

of complete edentulous upper and/or lower jaw with upper and /or lower full dental prosthesis placement, including and regular examinations for a period of 4 years for people over the age of 65 with health insurance [8]. This led to a relative increase in the amount of fabricated total dental prostheses in our country.

Strong atrophy of the alveolar ridge is often observed in patients who have been totally edentulous for a long time, which makes it difficult to retain and stabilize the prosthetic structure in the oral cavity. In the cases we present, the patients complain of poor retention and inability to use the total dentures. This provoked us to look for a way to overcome this discomfort and ensure stability during the masticatory function.

We conducted a similar experiment and produced partial dentures using thermoforming technology a few months ago [4]. Based on the successful result, we decided to conduct a new experiment to change the laboratory protocol for making a total dental prosthesis using thermoforming technology. We shared our idea with a dentist and got his consent, as well as the patients' consent.

In our opinion, the end result is very good, and for this reason we decided to share our experience after testing it in practice. The photos shown in the article are of some of the steps of the laboratory protocol described in the text.

We used thermoforming technology and a 2 mm thick Erkodent firm film. We finished the prostheses with self-polymerizing plastic, using a cuvette, which we use to make rebasing of ordinary plaque prostheses. To remove the residual monomer and improve the qualities of the plastic, we placed it in a hydro-pneumopolymerizer at 45 °C for 15-20 minutes.

We have found that the innovative laboratory protocol we used is relatively fast, provides very good accuracy and stability and is not particularly difficult to implement.



Image 7: A denture ready for delivery to the dental office (own archive)



**Image 8: A denture ready for delivery to the dental office (own archive)**

The plastic we use is bonded to the foil. The final result from the experiment, which was expected to be excellent, was also confirmed by the dental doctor immediately after the placement of the total dentures in the mouths of the patients.



**Image 9: Complete lower total prosthesis**



**Image 10: A patient with an upper total prosthesis**

The plaque part is thin; fits tightly over the entire prosthetic field, covers perfectly the boundaries and these are some of the prerequisites for good retention and stability.

The patients, who have been under observation, have shared that they are satisfied with the aesthetics, but what is more important to them is that the prostheses are very comfortable and stable during their function.

## V. CONCLUSION

We can share that the conducted experiment to make total dental prostheses using thermoforming technology turned out to be very successful. It fully met our expectations which prompted us to share our experience and we hope that the

present article will reach more readers and thus be useful to fellow dental technicians.

According to the patients, the prostheses have very good aesthetics, can be retained very well and have a very good stability during their function, unlike the previous plaque prostheses, which were only worn for a month.

Despite the strong atrophy we have observed in all three patients, the dentist has confirmed their opinion that the dentures are comfortable, functional and aesthetic.

The satisfaction of the other members of the dental team – the patient and the dentist – has brought us the satisfaction of a task which has been successfully finished and also give hope that the knowledge, experience, creative approach and sharing of innovative ideas tested in practice will positively influence the development of dental mechanics practice for the benefit of the patient.

Our team, which has conducted the experiment, has an idea to register its innovation in the Patent Office of the Republic of Bulgaria.

## REFERENCES

- [1] Hristozov, T. (1974). Propedeutics of orthopedic dentistry, Medicine and physical education, Sofia, p. 292.
- [2] Olivieri, A., Tiberi, M. (2020). Total dental prostheses. Recommendations regarding the process of manufacturing total dental prostheses: in search of facilitation, Infodent - BG, Sofia, p. 135.
- [3] Peev, T. (for editing) (1997). Dental prostheses and orthodontic appliances, MF, Sofia.
- [4] Varneva M., Kostadinov, M. (2022). Fabrication of a Temporary Removable Partial Denture Using Thermoforming Technology (Dental Mechanics Medical Practice Casese), International Research Journal of Innovations in Engineering and Technology, Vol 6, Issue 7, IRJIET,p. 56-59.
- [5] Yoshimasa Takeuchi, Hiroyasu Koizumi, Hideyuki Imai, Mika Furuchi, Masaki Takatsu, and Saiji Shimoe. (2022) Education and licensure of dental technicians, J-STAGE Advance Publication: Journal of Oral Science, 16 July.
- [6] <https://dentapro.bg> ((Mihailov G., Types of total dental prostheses, 24.09.22).
- [7] <https://grishacekov.webnode.page/products-/ortopedichno-lechenie/totalni-protezi/> (Tsekov Gr., Orthopedic treatment, Total Dental Prostheses, 12.12.22).
- [8] <https://blsbg.com/bg/3258.proekt-na-nrd-2018g.html>
- [9] <https://blsbg.com/bg/3258.proekt-na-nrd-2018g.html>(National Framework Agreement, 2018).

#### AUTHORS BIOGRAPHY



**Mihaleva Varneva,**

Associate Professor at Medical College – Varna, Medical University – Varna, Varna, Bulgaria; author of more than 100 articles and 4 textbooks for Dental Medicine; participant in 40 national and international Dental Medicine conferences; Member of the Bulgarian Association of Dental Technicians.

e-mail: [mihaela.varneva@mu-varna.bg](mailto:mihaela.varneva@mu-varna.bg)



**Milen Kostadinov,**

Dental Technician at the Medical College, in the structure of the Medical University "Prof. Dr. P. Stoyanov"- Varna since 2015. Dental technician in the dental laboratory at the medical and dental center of the Medical University "Prof. Dr. P. Stoyanov" – Varna since 2016.

#### Citation of this Article:

Mihaela Varneva, Milen Kostadinov, "Fabrication of Total Dentures Using Thermoforming Technology" Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 7, Issue 6, pp 26-30, June 2023. Article DOI <https://doi.org/10.47001/IRJIET/2023.706005>

\*\*\*\*\*