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Fabrication of a Temporary Removable Partial Denture Using Thermoforming Technology

(Dental Mechanics Medical Practice Cases)

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***Abstract* - In dental there are various technologies for the fabrication of removable partial and complete dentures. During the process of our practice it has been found out that dental thermoforming technology can be applied in combination with the standard methods and tools, and, as a result, a temporary removable dental prosthesis construction for restoring the defects of the dental rows can be fabricated. The functional success of the prosthesis depends on many factors, but its stability in the oral cavity plays a vital role for its acceptance by the patient. The aim of the present article is to share our experience by presenting a protocol for the fabrication of temporary partial dental prostheses using dental thermoforming technology. In order to fulfill this goal a multidisciplinary team has been formed. We have talked to dentists and patients who agreed to test our idea in practice. We have observed more than 10 patients and collected photographic material, which is partially presented in the article. In general, the protocol we follow in some of the steps is linear, but there are several differences in the different laboratory stages and the materials used. It has been found that dental alveolar hooks are slightly elastic and posses aesthetic value. The parents have reported that denture structures are not only stable, but also comfortable and aesthetic. The dentists, who agreed to implement our idea, are surprised by the results and strongly support this method.**

Keywords: partial denture, thermoforming, laboratory protocol, observation.

I. INTRODUCTION

The masticatory system is characterized by complex functional processes. Its normal functioning requires a balance between the various components – the teeth, periodontium, masticatory muscles, neck muscles, mandibular joint and the psyche of each individual [3].

The dictionary of prosthetic terms defines the masticatory system as "organs and structures functioning primarily in the process of chewing". It is said to "include the teeth with their supporting structures, the temporomandibular joints, the upper and lower jaws, the musculature, the tongue, the lips, the cheeks, the oral mucosa and the corresponding neurological complex" and to perform vital functions such as sucking, chewing, swallowing and speaking [3,5].

According to Koolstra, functional and structural changes in each of the components of the masticatory system can result in both functional and structural disorders in the other components [3,7].

The loss of teeth can lead to the following: beginning of bone resorption, changes in the elasticity of muscle tone, changes in the movements of the lower jaw, modification of the "paraprosthetic organs" – lips, tongue and cheeks, as well as changes in sound production. After extraction, the bone edge is reduced and bone resorption occurs as a consequence. The fabrication of temporary denture construction is extremely important because it benefits the mental trauma of teeth loss, restores the normal chewing and speaking functions and prevents the cheeks from sagging. A properly planned dental support structure allows the retention, stability and preservation of the alveolar ridge. The linear technique is most frequently applied as a result of the communication between dentists and dental technicians in regard to the production of temporary removable dentures [4].

Bulgarians seriously underestimate the health of their teeth. According to various research resources, about 2 million have at least one extracted tooth [2,10]. According to Eurostat data for 2017, visits to the dentist tend to become increasingly rare – over 80% did not have their teeth checked by dentist, 18% visited the dental office just once or twice and only 2% – more than five times for the year [2, 11]. Almost all people at the age of 18 have at least one extracted tooth, while those at the age of 35 already have six extracted teeth and as well as teeth affected by caries. 20% of the representatives of the population aged over 60 years have a completely edentulous upper jaw, 17% have no teeth in the lower jaw, and 13% have no teeth in the mouth at all. The opportunities for oral health

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in our country are limited, and, in addition, very few Bulgarians seek treatment [2, 10]. Dental treatment in the country is expensive and the income of Bulgarians are low [2, 9]. Removable prostheses are most common in older patients. The economic situation predefines to the choice of constructions that patients can afford [9].

The fabrication of a removable partial denture is a challenge. A successful dental construction must be strong – not to wear oof or break down, retentive – to remain stable in the oral cavity during its functions, esthetic – to satisfy the patient's expectations and be unnoticable, and painless – not to cause discomfort [1].

In the recent decades, tolerability and possible side reactions to dental materials have been a major topic in the dental field. One of the major goals of any dental mechanics procedure is the optimal use of biocompatible materials. Biocompatibility regards to the ability of the material to behave neutrally under different conditions in the human body, so that side effects do not occur [8]. Dental thermoforming technology deals with this type of biocompatible materials – foils of different thickness and hardness depending on the application in practice – in stages of fixed prosthetics, removable prosthetics, orthodontics, teeth whitening splints, bruxism and snoring splints, sports splints/ mouth guard protectors [12].

II. AIM

The aim of the present article is to present a protocol for the fabrication of temporary partial dental prostheses using a mixed method – dental thermoforming technology in combination with standard methods and tools.

III. MATERIALS AND METHODS

In order to fulfill the purpose of the study, we have carried on conversations with patients and dentists, who agreed to test the described protocol in practice and, as a consequence, they shared their opinions after placing the partial dentures. We have also observed more than 10 patients and collected photographic material, which is partially presented in the article.

IV. RESULTS AND DISCUSSION

Partial removable dentures have always been a frequently used means of restoring the defects of the dental rows. Temporary prosthetic structures are not only made for aesthetic reasons, but also to allow the patients to fulfill their social obligations and have normal chewing and speech functions until the permanent structure is ready. There are multiple available theoretical resources and articles, which describe numerous clinical cases and different technologies.

The protocol we follow in some of the steps is linear, but there are several differences in the different laboratory stages and the materials used.

Dental thermoforming technology offers a great variety of possibilities. The way we have applied it in practice is innovative and not widely used for the fabrication of temporary dental structures. We have found that the best results are achieved when Erkodent foils are used.

V. LABORATORY PROTOCOL

- Casting of working models (of the upper and lower jaw and a second model of the working jaw) from plaster class III or IV.
- Placing the model in the granule container and pulling out the rigid foil.
- Excision along the borders of the prosthesis and dental alveolar hooks with files.
- Sending the model to the dental office to determine the height of the bite using a wax shaft.
- Orienting the models in an occluder or articulator.
- Selection of teeth with suitable size and color.
- Placing the artificial teeth and modeling with wax.
- Making a silicone key from laboratory silicone.
- Cleaning the wax with a dental steam jet cleaner.
- Alignment of the teeth in the silicone key.
- Placing plastic and pressing the key onto the model.
- Placing the model in a vessel for polymerization in water under pressure (at a temperature of 40° and 2.5 atm.) for about 10 minutes.
- Cleaning and polishing of the finished partial temporary dental prosthesis.

Figure 1

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Figure 2

Figure 3

Figure 4

Figure 5

Figure 1-5: Temporary partial dentures (private archive)

In thermoforming technology there is a thinning of the foil when it is drawn – 1 cm of the height of the model corresponds to about 20% loss of thickness. Therefore, we use a foil with a thickness of 2 mm (Erkodent), which provides the necessary stability and thickness (1.6-1.8 mm) on the plaque part of the prosthesis. According to the manufacturer, the film bonds with a self-polymerizing acrylic pink paste used in dental practice, which allowed us to make the removable prosthetic structures we present. According to the description by the manufacturer, the foil bonds with a self-polymerizing acrylic pink plastic used in dental practice, which has allowed us to make the present removable prosthetic structures.

The laboratory protocol can be described in four words – simple, fast, accurate and aesthetic. It is easy to apply as well as time-saving, which is a main advantage in a dental mechanics laboratory due to the regular shortage of time. The protocol is also cost-efficient in regard to the materials used. It also allows an accurate placing in the patient's mouth and has an aesthetic appearance – the hooks are transparent and are located close to the cervical region. They are elastic, which makes the placement and removal of the dentures easier for the patients.

The present protocol for the fabrication of temporary removable denture structures can be used for small defects in the dental rows (from one to several missing teeth). The photographs illustrate that the dental prostheses can be fabricated with equal success for the upper and lower jaws, for both distally unrestricted and distally restricted defects.

Picture 5 shows a temporary partial denture in a bilateral edentulous case with a bilaterally unrestricted defect. Its layout and boundaries resemble a skeletal structure. A part of the hard palate is released in order to relieve the patient, which did not affect the strength and the stability of the dental structure in any way.

If the alveolar hooks are broken, the repair is extremely simple and fast, which makes the working protocol even more favorable and desired.

The method we have used gives a new life to the Kemeny prosthesis.

VI. CONCLUSION

The functional success of the removable dentures depends on many factors, but its stability in the oral cavity and its aesthetics are of leading importance for its acceptance by the patientc.

The presented protocol is simple, fast, accurate and ensures good aesthetics and patient tolerance. The temporary partial denture is fixed firmly on the prosthetic field. It is

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stable and allows comfort during the chewing function. The hooks are transparent and unnoticeable.

The protocol is satisfying for all members of the dental team – the dental technician and the dentist are pleased with the excellent completion of the work and the satisfaction of the patients. At the same time the patients are happy with the comfortable and aesthetic temporary denture construction and report that they lead a normal social life, eat without any difficulties and smile without worry.

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