

## Funkčné aparáty v súčasnej zubnej technike na Slovensku

### Functional appliances in current dental technique in Slovakia

Lysý Juraj<sup>1</sup>, Knošková Eliška<sup>2</sup>, Lysá Zuzana<sup>3</sup>, Škarbová Iveta<sup>2</sup>, Moravčíková Ľubica<sup>2</sup>

<sup>1</sup> Department of Stomatology and Maxillofacial Surgery, Faculty of Medicine, Comenius University in Bratislava

Klinika stomatológie a maxilofaciálnej chirurgie Lekárskej fakulty Univerzity Komenského

<sup>2</sup> College of Health and Social Work of St. Elizabeth in Bratislava

Vysoká škola zdravotníctva a sociálnej práce svätej Alžbety v Bratislave

<sup>3</sup> 1st Department of Paediatrics, Faculty of Medicine, Comenius University in Bratislava

1.detská klinika Lekárskej fakulty Univerzity Komenského

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Recenzent/Review: MUDr. Dušan Poruban, CSc.

Onkologický ústav sv. Alžbety, s.r.o. Bratislava

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**Abstract: Objective:** The aim of the study was to assess current trends in laboratory fabrication of functional appliances in Slovakia.

**Material and methods:** 117 dental technicians who report due to the database of the Slovak Chamber of Dental

Technicians in job descriptions orthodontics were asked to fill in a questionnaire. The questions were focused on the spectrum of manufactured functional appliances and the technological procedures used for their manufacture.

**Results:** 56 fully completed questionnaires with adequate representation from all regions of Slovakia were evaluated. Most frequent functional appliances are passive tooth-borne monoblock appliances (monoblock - 42%, Balters bionator 7%), twin-block (25%) and Frankels functional regulator (18%). Technological procedures used in manufacturing are salt and pepper (38%), knead - on (20%), fluid resin (19%) and technique using light-cured resin (17%). The most often used of fixator at technical fabrication is the plain articulator (78%) and the average articulator (22%).

**Conclusion:** Current technologies are used in laboratory fabrication of functional appliances in Slovakia. Representation of manufactured appliances confirms modern trends in orthodontics.

Key words: Functional appliance, dental technician, technology, orthodontics

### Abstrakt.

**Cieľ:** Cieľom štúdie bolo zistiť súčasný trendy v laboratórnom zhotovovaní funkčných aparátov na Slovensku.

**Materiál a metódy:** Formou dotazníka bolo oslovených 117 zubných technikov, ktorí udávajú podľa databázy Slovenskej komory zubných technikov v popise práce aj čeľustnú ortopédiu. Otázky boli

zamerané na spektrum zhotovovaných funkčných aparátov ako aj na technologické postupy používané pri ich zhotovení.

**Výsledky:** Vyhodnotených bolo 56 kompletne vyplnených dotazníkov s primeraným zastúpením všetkých regiónov Slovenska. Najčastejšie zhotovované aparáty sú aparáty typu monoblok (monoblok – 42%, bionátor podľa Baltersa 7 %), twinblok (25%) a Fränklove regulátory funkcie (18%). Najčastejšie technologické postupy pri zhotovení bázy sú sypacia (38%), modelačná (20%) technika, technika liatia (19%) a technika s použitím svetlom tuhnucej živice (17%). Najčastejšie používaný fixátor pri zhotovení funkčných aparátov je oklúdor (78%) a priemerný artikulátor (22%).

**Záver:** Pri laboratórnom zhotovení funkčných aparátov na Slovensku sa používajú súčasné technológie. Zastúpenie zhotovovaných aparátov potvrdzuje moderné trendy v čeľustnej ortopédii.

**Kľúčové slová:** funkčný aparát, zubný technik, technológia, ortodoncia.

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### Introduction.

Attempts to influence the growth and development of facial bones can be dated back to the 19th century. The pioneer was

Norman Kingsley, who first successfully introduced extraoral traction in the treatment of retroclulsion. He tried to treat retroclulsion also in another way by a special plate made of vulcanite with an oblique ramp guiding mandible during mouth closing into an anterior to stimulate the mandibular growth. Further progress was the monoblock constructed in 1902 by Pierre Robin to correct jaw development in children with glossoptosis. But the mass use of functional appliances had to wait until the 30-ies of the 20th century. In this period synthetic methacrylate resins were successfully introduced in the dental practice allowing cheap and easy production of durable removable prostheses and orthodontic appliances. To this period also the split between the American and European orthodontic school is dated. In the United States fixed appliance treatment dominated. They were at that time fabricated individual and often from precious alloys, what made the entire treatment expensive and available only for solvent patients. Removable appliances were used rarely. In Europe, under the influence of social movements since the mid-19th century gradually state health insurance was introduced, which should ensure the availability of health care for everybody. This led to searching for cheap medical treatments, which included the use

of removable orthodontic appliances. In 1935 introduced Vigo Andresen and Karl Häupl the Norwegian regulatory system, which is a functional orthodontic treatment based on the use of the monoblock appliance. This is used in various modifications until today. A different philosophy of functional orthodontic treatment introduced Rolf Fränkl in 1961. The basic idea of the Frankels appliances is to promote growth of deficient skeletal structures screening out the soft tissues that surround them. Finally, the last group are double plates, which were originally introduced by Schwarz ill in the 30s. The current most commonly used modification known as twinblock was introduced in 1977 by William Clark.

### **Materials and Methods.**

117 dental technicians, who report due to the database of the Slovak Chamber of Dental Technicians in job descriptions orthodontics, were asked to fill in this questionnaire:

1. Which type of functional appliance are you making most often?
  - a) Monoblock
  - b) Frankel appliance
  - c) Twin-Block
  - d) other (e.g. Bimler ...) please specify

2. Which construction technique are you using most often?

- a) salt and pepper technique
- b) casting technique
- c) technique using light cured materials
- d) other, please specify

3. Which polymerization method are you using most often?

- a) light cured
- b) boiling method
- c) pressure method

4. Which type of fixator are you using most often?

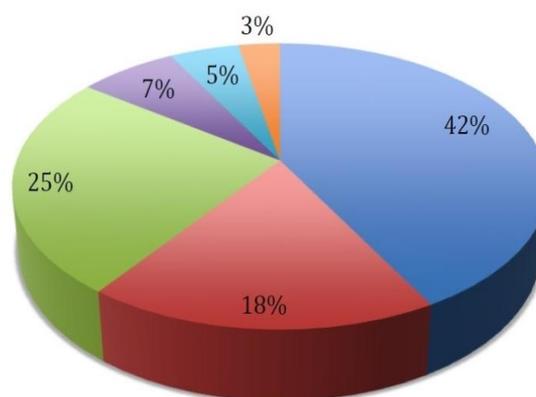
- a) plain articulator
- b) average articulator
- c) individual articulator

If the dental technician has indicated more options, it was necessary to assign to each option the score of occurrence of 1 to 10. Sum of the numbers assigned to the answer is always 10.

## Results.

Overall, we managed to complete 56 questionnaires which proportionally represent all regions of the Slovak Republic. The relatively low response rate in more than three quarters is justified by

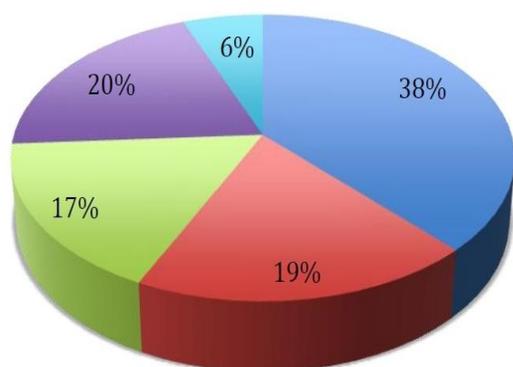
the fact that although dental technicians job description is also orthodontics, but in reality he does not it perform. For this reason, the collected questionnaires make a representative sample for Slovak Republic. Answers to question 1 " Which type of functional appliance are you making most often?" are shown in graph 1. The results indicate that the most common manufactured functional appliance with 42% is the monoblock. The second most frequent is the twin-block appliance with 25%.



Graph 1 Representation of fabricated functional appliances. ■ Monoblock Activator, ■ Twin-Block, ■ Frankel Functional Regulator, ■ Balters Bionator, ■ Bimler Appliance, ■ Elastic Opened Activator by Klammt

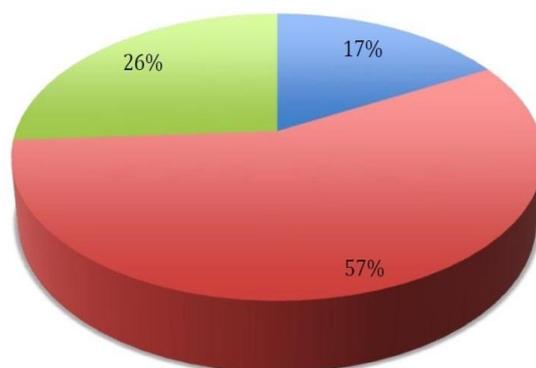
Answers to question 2 " Which construction technique are you using most often?" are shown in graph 2. The most common technique with 38% is the Salt and Pepper technique. With about the same

proportion the knead-on (20%), fluid resin (19%) techniques and technique using light-cured resin (17%) are used. Compression molding technique is rarely used only in 6%.



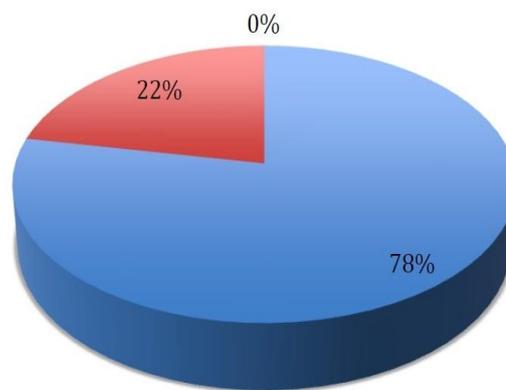
Graph 2 Representation construction techniques. ■ Salt and Pepper technique, ■ Fluid Resin technique, ■ Light cured resin method, ■ Knead – on technique, ■ Compression molding technique.

Answers to question 3 " Which polymerization method are you using most often?" are shown in graph 3. The most common way with 57% is boiling. Rarely used are the pressure (26%) and light (17%) polymerization.



Graph 3 Representation of polymerization techniques. ■ boiling, ■ pressure, ■ light

Answers to question 4 " Which type of fixator are you using most often?" are shown in graph 4. The most commonly used fixator is plain articulator, with 78%. Rarely used is an average articulator (22%).



Graph 4 Representation of used fixator. ■ plain articulator, ■ average articulator, ■ individual articulator.

### Discussion.

Functional removable appliances are still important orthodontic treatment. Enthusiasm, which persisted since their introduction in the early 20th century to the 80s is gradually relieved by scepticism and the need of fundamental reconsideration of their use in orthodontic treatment. The original idea of ability to influence development of orofacial skeleton in the transverse, vertical and horizontal planes in terms of activation or blocking by functional environment modification increasingly encountered problems with establishing a real, evidence based effect. It is now accepted fact that functional, removable appliances are not able to block mandibular growth (De Clerck HJ, 2015). Also their effect in skeletal open bite treatment is highly questionable (MF Feres, 2015). For skeletal deep bite and transverse anomalies treatment more efficient appliances are known than those from the group of functional. The only skeletal effect, which is until now scientifically accepted is mandibular growth stimulation especially during the pubertal growth spurt (Perinetti G, 2015). But here we face the problem with the effectiveness of various types of functional appliances. In terms of relation to intraoral structures removable functional appliances

can be classified into three groups (Proffit WR, 2013).

The first group are active tooth-borne appliances. These are in most cases monoblock modifications combined with various active elements such as screws and springs. This group also includes the Elastic Opened Activator by Klammt or the Bimler Appliance. The presence of active elements has proved to be extremely problematic. Dislocating the appliance of its place in the oral cavity and mechanically influencing teeth with the result of changing their position. This simultaneously reduces the skeletal effect of mandibular positioning and increases the dental compensation effect. These devices have little or no place in modern orthodontics. Our research showed that this type of appliances is constructed only in 8% of cases, which absolutely corresponds to current trends.

The second group are passive tooth-borne appliances. These devices have a rigid body, which by mouth closure forces mandible into forward position, thus stimulating growth in articular cartilage. They are supplemented by the retention elements, which clearly define the appliance position in the oral cavity. This group includes monoblock activator and the Balters Bionator. They are constructed in 49% of cases. Into this group due to a

similar effect the twin-block can be classified. The current view of these appliances in terms of efficiency is that the twin-block is more effective than monoblock in influencing skeletal growth (P Cozza, 2006; Pacha MM, 2015). As our research has shown the traditional monoblock still dominates in Slovakia. One fourth appearance of twin block is by no means negligible, and is a sign of a significant shift in Slovakia orthodontics where these devices began to significantly promote from the 90s.

The last group are tissues-borne appliances with the most important representative, the Frankel functional regulator. Their functional effect was not till today called into question but the effectiveness of treatment is in the eyes of today's science questionable. They are used in Class II, III and open bite treatment (Lentini-DA Oliveira, 2014; Yang X 2014; Angelier F, 2014). They are highly challenging in technical fabrication. That is why the 18% share demonstrates high level of Slovak orthodontic dental technique.

The most common fabrication technique of functional appliances is the salt and pepper technique. This is a procedure where after application of separating media the polymer is sprinkled over the cast. Then the monomer is introduced from a dropper. This process is repeated until the desired

volume and shape of the base is achieved (Caesar HH, 2008). The advantage is simplicity, high accuracy and a small amount of waste. The major disadvantage of the process is the need to work with the monomer, which is volatile and irritant. This disadvantage is eliminated in the technique of using light-cured resin. It is a modern modification of the knead-on technique. The base is created from a special resin and its curing is achieved by polymerisation initiation with light of a specific wavelength (J Brown, 1998). The traditional knead-on technique is using a chemical cured resin that has to be adapted during the plastic phase on the plaster model. The main disadvantage is like in the salt and pepper technique working with the irritable monomer. Surprising high is the use of injection technique. A sprue hole and a vent hole are formed in the plaster model or between a plaster model and silicone. Fluid resin is injected under pressure into the mold space. There is no difference in physical properties or in accuracy compared with the traditional compression molding technique that is used rarely.

The most common fixator in construction of functional appliances is a plain articulator. This is a simple method of model fixation, that does not allow any articulation movement simulation. In most

cases this is not necessary, because the intermaxillary relationship is set by construction wax-bite by the most perfect individual articulator - the patient himself. Working with a plain articulator is simple and effective. The use of individual articulator indicated no one. Nevertheless, in specific indications that require accurate analysis of gnathological parameters its use is necessary (TD Freeland, 2012). Average articulator is used in the construction of about a quarter of cases. It allows the dental technician to simulate articulation movements at a ratio that is usually sufficient for making functional appliance in a more specific indication.

### Conclusion.

Functional removable appliances are an integral part of the spectrum of orthodontic appliances even their use is in comparison with the past reduced. Their versatility in terms of skeletal characteristics correction was unfortunately scientifically not confirmed. Therefore, they are used in specific indications at a specific age. Also, the spectrum of manufactured appliances has changed compared to the past. Former standard monoblock appliances are gradually changed by more efficient appliances such as the twin-block or the technically challenging Frankel functional

regulator. In the past preferred active tooth-borne appliances with their nowadays scientifically proven dentoalveolar compensation effect, are rarely used. Also in the fabrication technology a significant progress towards more modern and simple techniques such as the use of light-cured resin is seen. Relatively frequent use of average articulator points to increasing equipment level of orthodontic technicians who are interested not only in the appliance construction, but also in understanding of its relationship to the dynamic environment of the oral cavity.

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**Contact of author:**

MUDr. et MUDr. Juraj LYSÝ, PhD.,  
MHA

Department of Stomatology and  
Maxilofacial Surgery

Faculty of Medicine, Comenius University  
in Bratislava

Heydukova 8

812 50 Bratislava

jurajlysy@gmail.com