



CODEN [USA]: IAJPBB

ISSN: 2349-7750

**INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES**<http://doi.org/10.5281/zenodo.1174172>Available online at: <http://www.iajps.com>

Research Article

**USE OF VECTOR PATTERNS FOR MANUFACTURING OF
INDIVIDUAL PROTECTIVE DENTAL SPLINTS BY METHOD
OF THERMOFORMING****V.V. Borisov¹, A.V. Sevbitov¹, Nikolai Poloneitchik², I.M. Voloshina³.**¹ I.M. Sechenov First Moscow State Medical University of the Ministry of Health of the Russian Federation (Sechenov University): Russia, Moscow² Belarusian State Medical University: Minsk, Belarus.³ Omsk State Medical University: Russia, Omsk.**Abstract:**

Research objective is to increase effectiveness of teeth protection by use of an individual protective dental splint which is produced by method of thermoforming of layers of copolymer of ethylene with vinyl acetate with the help of apparatus THERMOFORMER 2.1. Within the framework of the research a method was developed for production of a vector pattern which allows to transfer borders of the individual protective dental splint onto a blank in order to increase the quality of production of protective splint and to increase comfort of its use. While modeling the pattern we used the vector graphics editor CorelDRAW. results of the research show that the maximum value of retention depends on pressure force during formation of the first layer of the splint. Borders of basis of an individual protective dental splint have a minimal effect on level of retention of the splint. This allows to adjust splint borders maximally and to make the cut from the side of palate up to base of alveolar bone of the upper jaw and incisive papilla at the front. Thereby the probability of vomiting reflex is lowered and adaptation time is reduced.

Key words: THERMOFORMER 2.1, CorelDRAW, mouthguard, EVA.**Corresponding author:****Borisov Vitaly Victorovich,***PhD in Medical sciences, associate Professor,**Department of dental propeudetics,**I.M. Sechenov First Moscow State Medical University of the Ministry of Health of the Russian Federation (Sechenov University),**Ministry of Health of Russia;**E-mail: karapeta12121985@gmail.com*

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Please cite this article in press as V.V. Borisov et al., Use of Vector Patterns for Manufacturing of Individual Protective Dental Splints by Method of Thermoforming, Indo Am. J. P. Sci, 2018; 05(01).

INTRODUCTION:

Dental trauma is a serious problem of public health. Trauma of maxillofacial region, which is received during sports activities, requires not only a treatment but a long rehabilitation of the victim too. It must be remembered that treatment and further rehabilitation will result in considerable financial expenditure. And as a consequence, complications and dysfunctions of mastication, speech and breathing are possible [1].

A trauma can lead to abnormality of process of secondary dentition and process of forming of their integrity. Degree of these abnormalities depends on child's age and nature of trauma. Abnormalities of individual tooth tissues (enamel hypoplasia) or change in color of a permanent tooth crown are possible. A trauma of alveolar bone or a temporary tooth can result in an inflammatory process which leads to affection of dental germ or body of jaw.

Age of patients, who are treated by a dentist because of dental trauma, as a rule, ranges from 7 to 65 years. About 66 % of all victims are children. Hecova H. reports that children suffer more often than adults and are more prone to traumas of dentofacial system. It can be explained by high motion activity of children and their great mobility. Children's traumas of teeth and alveolar bone can lead to grave consequences. Traumatic injuries can result in formation of defects of crowns of individual teeth and whole rows of teeth. More frequent are traumatic injuries of crowns of upper teeth, more rare are the ones of lower teeth (as results of strokes, falls, biting on hard objects, result of a long mechanical impact when, for example a person holds various objects by his teeth and because of other reasons). The most frequent causes of injuries of dentofacial system in children older than 11 years were traumas which had been received during sports activities. Transverse fracture within cemento-enamel junction amounts to about 26.2% of all cases. Dental dislocations amounted to 23.3%. Such forms of injuries were in the majority among adolescents. In addition to traumatic injuries of hard teeth tissues, an injury of neurovascular bundle (pulp) was detected too. [2]

For prevention of traumas of dentofacial system one must use a protective splint as a device for prophylaxis of injuries of teeth, alveolar bones and soft tissues which adjoin them. A protective dental splint can maximally prevent traumas of teeth. For securing of full comfort and maximal retention of the splint it must be produced by a dentist with the help of modern equipment and must meet all requirements, that allows to hold the splint on teeth at any intensity of sportsman's movements and in that

way allows to increase effectiveness of prevention of dental traumas. Good retention secures a correct breathing and speech function what is rather important for a sportsman [3-4].

MATERIALS AND METHODS:

Research objective is to increase effectiveness of teeth protection by use of an individual protective dental splint which is produced by method of thermoforming of layers of copolymer of ethylene with vinyl acetate with the help of apparatus THERMOFORMER 2.1.

Within the framework of the research a method was developed for production of a vector pattern which allows transferring borders of the individual protective dental splint onto a blank in order to increase the quality of production of protective splint and to increase comfort of its use. While modeling the pattern we used the vector graphics editor CorelDRAW. The software allows producing and editing patterns directly on the monitor of a computer. CorelDRAW becomes popular among dentists too. Form of the pattern remains unchanged; one has only to enter individual dimensions of depth of vestibule of oral cavity [5].

Under the auspices of Department of Propedeutics of Dental Diseases in I.M. Sechenov First Moscow State Medical University the research was conducted during which the level of retention of a protective splint on the dentofacial system was determined when borders of splint basis were different - 1.5 и 3.0 mm, the pressure varied too - 1.5 и 2 atm.

Twelve protective splints were produced with the help of thermoformer "Averon" 2.1; these splints had different borders of basis and were intended for different parameters of pressure on the upper jaw from 1.5 atm to 2 atm. After this we examined level of retention of the protective splint on phantom models with the help of an electronic balance.

RESULTS OF OWN RESEARCH:

results of the research show that the maximum value of retention depends on pressure force during formation of the first layer of the splint. Borders of basis of an individual protective dental splint have a minimal effect on level of retention of the splint. This allows to adjust splint borders maximally and to make the cut from the side of palate up to base of alveolar bone of the upper jaw and incisive papilla at the front. Thereby the probability of vomiting reflex is lowered and adaptation time is reduced.

CONCLUSIONS:

The patterns, which are produced with the help of vector software, allowed to evaluate retention of an individual protective dental splint maximally.

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